OPERATING AND SERVICE MANUAL
FOR MODEL 737LC
DUAL BAND, WIDEBAND RF POWER AMPLIFIER
PART NUMBER 1-30-425-001

SERIAL NUMBER 7355C-2

KALMUS

21820 - 87th S.E. ■ Woodinville, WA. ■ 98072, USA

(206) 485-9000 ■ (206) 486-9657 fax

A division of Thermo Voltek Corp., A Thermo Electron company

Digitized by the Internet Archive
in 2025

https://archive.org/details/manualsplus_06936

Final Test Data

Linear CW Systems

Model 737LC Serial Number 7355C-2

Description RF POWER AMPLIFIER

Date 03-21-96 Invoice

Customer GE COMPUTER SERVICE

Frequency MHz	Input Required For One Half Power dbm	Input Required For Rated Pwr 25 W dbm	Rated Pwr Harmonics 2nd 3rd dbc	Rated Pwr Comp in dB	Max Pwr or ALC Watts
0.01	-4.2	-1.2	45 26	0.1	28.0
0.1	-5.0	-1.0	32 19	0.7	28.5
2.5	-6.2	-2.7	32 21	0.4	28.5
75	-5.3	-0.7	27 20	1.9	27.0
125	-4.8	1.8	25 25	4.4	26.0
200	-6.4	-1.0	38 45	3.1	27.5
200	-3.4	0.5	34 25	1.0	31.0
300	-5.8	-2.7	25 34	0.4	31.0
500	-6.2	-3.0	34 38	0.4	30.0
700	-4.2	-0.5	39 -	1.2	28.5
900	-3.2	0.5	- -	1.6	27.0
1000	-5.2	-1.3	- -	1.5	26.0

Frequency Range 0.01-200/200-1000MHz Average Gain @ 1/2 Power 46db

Flatness @ 1/2 Power ± 1.6db Flatness with ALC ±0.4db/±0.4 db

Gain Adjust Range 7.24db Meter Accuracy ±0.4/±0.4

Harmonics (Max) -19dbc Spurious ∠-70dbc

Noise ∠-95dbc @ 1MHz BW Reflected Power Limit Set 7-19w open

Remote Check ✓ Fan ✓

Primary Voltage 115VAC Primary Fuse Size 5.0A

Amps (No Load) 1.6A Full Load 3.1A

Tested by Approved by Date 3/19/96

KALMUS

21820 87th Ave. S.E., Woodinville, Wa. 98072

Phone 206 481 8833

Fax 206 486 1002

Certificate Of Compliance

KALMUS

Customer GE COMPUTER SERVICE Shipping Date 03-21-96

P.O. No: 174670 Part No. MODEL 737LC

W.O. No. 7355

It is hereby certified that the equipment shown below conforms to the requirements of your purchase order and is constructed from all new materials and in accordance with accepted industry workmanship practices. The measured performances meet or exceed the applicable specifications except as follows:

Equipment delivered under this document:

Description	Part No.	Serial No.
RF POWER AMPLIFIER	1-60-425-001	7355C-2

The following additional requirements have been complied with:

Signed By:

Title:

Date: MARCH 21, 1996

LIMITED WARRANTY

KALMUS

KALMUS warrants each product to be free from defects in material and workmanship for a period of (18) eighteen months from invoice date. KALMUS will repair the product at no charge for parts and labor should failure prove to have been caused by a factory defect as disclosed by our examination. Vacuum tubes are warranted for 90 days after invoice date.

This Warranty does not apply to:

1) Damage or malfunction caused by:
   a.) Accident, misuse, fire, lightning, or other acts of nature, unauthorized product modification, or failure to follow operational procedures provided with the product.
   b.) Installation or removal of the product to or from other equipment.
   c.) Any shipment of product to destination (claims to be filed with the freight carrier).
   d.) Any semiconductor failure when the system is not operated with a KALMUS power supply.
   e.) Any other cause not attributable to product defect.
2) Any product which was not originally purchased from KALMUS or an authorized representative.
3) Any product with removed or altered serial numbers.
4) Repair or attempted repair by anyone without written authorization from KALMUS.

Prior to returning any KALMUS product for repair, please contact our service department at (800) 344-3341 for precise shipping instructions. Freight shipped without prior factory authorization may be rejected and returned to sender. Collect shipments are not accepted, however KALMUS will pay for freight charges back to customer for warranty repairs.
For out-of-warranty repairs KALMUS will submit an estimate for approval prior at actual repair.

All KALMUS products needing to be returned for service should include written correspondence describing events leading to failure and should be addressed with freight prepaid, to the address below.

KALMUS' LIABILITY FOR ANY DEFECTIVE PRODUCT IS LIMITED TO THE REPAIR OR REPLACEMENT OF THE PRODUCT AT OUR OPTION. KALMUS SHALL NOT BE RESPONSIBLE FOR:

1. DAMAGE TO OTHER PROPERTY CAUSED BY ANY DEFECTS IN THIS PRODUCT, DAMAGES BASED UPON INCONVENIENCE, LOSS OF USE OF THE PRODUCT, LOSS OF TIME, OR
2. ANY OTHER DAMAGES, WHETHER INCIDENTAL, OR CONSEQUENTIAL.

THERE ARE NO OTHER WARRANTIES, EITHER EXPRESS OR IMPLIED, INCLUDING ANY WARRANTY OR MERCHANTABILITY OR FITNESS FOR A PARTICULAR USE.

KALMUS 21820 - 87th S.E., Woodinville, WA. 98072, USA
A Subsidiary of Thermo Voltex and Thermo Electron Corporation

TABLE OF CONTENTS

1.0 DESCRIPTION AND OPERATION 4

1.1 General 4
1.2 Specifications 5
Special Features 7
Figure 1 -- Input/Output Diagram Remote Connector 9
Optional Equipment 11
1.3 Circuit Description 12
A. Amplifier Module 210L, A5 13
B. Amplifier Assy 720FL, A6 13
C. Power control circuitry, A2 - A4, A9 & DC1 14
1. Front Panel PCB Assy, A2 14
2. Reflected Power Control PCB Assy, A3 15
3. Forward Power Control PCB Assy, A4 16
4. Power Sensor 16
5. Control Circuit Operation 16
6. Blanking 19
7. Power Meter 19
D. Power Supply 19

2.0 Operation 20

2.1 General 20
A. Cooling 20
B. Safety Precautions 20
C. Connection To Power Source 20
D. Line Voltage Selection 20

3.0 OPERATION 21

3.1 Safety Precautions 21
3.2 General 21
3.3 Detailed Amplifier Operation 21
3.3.1 Front Panel Controls And Indicators 21
Figure 2. Front Panel Controls & Indicators 23
3.4 Remote Control Functions And Indicators 24
3.5 Placing Equipment In Service 25
3.6 Fuses 26

4.0 MAINTENANCE 27

4.1 General 27

5.0 ITEMIZED PARTS LIST 28

RF POWER AMPLIFIER, MODEL 737LC 29

A2--PCB ASSY FRONT PANEL DUAL BAND 31
A3--PCB ASSY PWR CTRL REFL 33
A4--PCB ASSY PWR CTRL FWD 34
A5--AMP ASSY 210L DRIVER FINAL 35
A5A1--AMP PCB ASSY DRIVER 210L 36
A6--AMP ASSY 720FL 38
A6A1--PCB AMP ASSY 720FL 39

5.0 DRAWINGS 41

737LC Wiring Diagram, 7-38-345-000 42
720FL Amplifier Assy, 4-62-186-002 43
720FL Amplifier PCB Assy, 4-30-332-004 44
Schematic 720FL Amplifier, 7-35-658-000 45
Front Panel PCB Assy, 4-30-380-001 46
Schematic Front Panel PCB, 7-35-730-000 47
Forward/Reflected Power Control PCB Assy, 4-30-377-001/-002 48
Schematic Forward Power Control PCB, 7-35-721-001 49
Schematic Reflected Power Control PCB, 7-35-721-002 50
210L Amplifier Driver PCB Assy, 4-30-382-001 51
Schematic 210L Amplifier Driver, 7-35-516-000 52
LFS44-28 Power Supply - APPENDIX 53

1.0 DESCRIPTION AND OPERATION

1.1 General

This manual covers the **Kalmus** Model 737LC, Dual Band, Wideband Power Amplifier and comprises a general equipment description, specifications, circuit description, operation and maintenance instructions and an itemized parts list. The manual is appended with the pertinent assy drawings and schematics.

The Model 737LC covers the frequency range of 10 kHz to 1000 Mhz in two bands, i.e., 10 kHz to 200 MHz and 200 MHz to 1000 MHz. Rated output power over these bands is 25 Watt CW, with typically 45 dB power gain. Power output is indicated on a front panel-mounted, analog meter.

The Model 737LC is built around two amplifier modules to cover the two frequency bands. These are the Model 210L and the Model 720FL. The input and output to these modules are switched by coaxial relays as selected from the front panel. Both modules are protected against excessive output mismatch and temperature; a front panel warning is provided for excessive input drive.

The power supply for this unit is a commercial, switch-mode type supply.

Remote operation of the amplifier is possible via a 25-pin, D-subminiature connector on the rear panel. GPIB control of the system is possible with the optional KEI IEEE488.2 or RS232 Interface see page 11.

The Model 737LC is a 19-inch, rack-mount unit, 18 inches deep and 5-1/4 inches high. The cabinet, which is of aluminum sheet construction, has removable front, rear and side panels and top cover. All front panel controls, except the power switch, rf gain control and input/output connectors, are located on a front panel-mounted printed circuit board.

1.2 Specifications

Frequency Range	:	0.01-1000 MHz (2 bands, coaxially switched) * Lo-Band .01-200 MHz * Hi-Band 200-1000 MHz
Power Output	:	25 Watt CW minimum
Power Gain	:	45 dB nominal
Drive Level Required	:	1 mW typical
Gain Control	:	25 dB typical, potentiometer control
Gain Flatness	:	± 1.8 dB maximum
ALC	:	± .5 dB for 10 dB input change, potentiometer control.
Temperature Stability	:	Better than 0.5 dB
Class of Operation	:	Class "A" Linear
Spurious Outputs	:	-70 dBc minimum
Harmonic Distortion	:	-20 dBc minimum
Input/Output Impedance	:	50 Ohm nominal
Duty Factor	:	100%
VSWR Tolerance	:	infinite VSWR
Protection	:	VSWR, over-temperature, overdrive see "**SPECIAL FEATURES**"
Operating Temperature	:	-10 to 50 deg. C
Connectors	:	Type N female out, BNC in
Cooling	:	Forced air
Front Panel Meter	:	0-25 Watt F.S.
Controls	:	[AC LINE] ON/OFF [RF CTRL] ON/OFF (blanking) [RF BAND] HIGH/LOW [ALC] FAST/SLOW (Autom. Level Control) [VSWR] RESET-AUTO/MANUAL
Indicators	:	SYSTEM, BLANKING, LOW band, HIGH band, ALC, VSWR, TEMP, REMOTE ACTIVE
Remote Control	:	provisions standard via 25-pin D-connector. Compatible with KEI IEEE488.2/RS232 INTERFACE page 11.
Primary Input Power	:	95 to 132 VAC, 47 to 440 Hz or 187 to 250 VAC, 47 to 440 Hz or 260 to 350 VDC; 600 VA; see Sec.2

AC Input Connector	:	Standard IEC with two 5 mm fuses
AC Line Selection	:	Selected at AC input module.
Fuses	:	two 6 A. time-delayed, 5 X 20 mm style, are located in the AC input power module.
Size H X W X D	:	5-1/4 X 19 X 18 in 133 X 483 X 457 mm
Weight	:	31 lbs, 14.1 kg
Construction	:	Modular. Aluminum enclosure. Removable front, rear and sides. All front panel controls and indicators, except power switch, gain control, and input/output connectors, are pcb mounted.
Color	:	Front panel - light grey semi-gloss, line and text -- two-tone dark grey. Cabinet and cover - olive green

Special Features

Over-Temperature Protection : Amplifier module(s) protected by temperature sense switches.

Indication: blinking, red LED

*off -- safe
*red -- temperature ≥160 °F, amplifier shut down as indicated by TEMP and BLANKING LED being lit.

Overdrive Protection : **Indication:** ALC indicator, red LED

*off -- safe
*red -- with ALC control in the OFF, full clockwise position, the system is being overdriven. Reduce input signal to safe level.

VSWR protection : The amplifier is protected against all load mismatch conditions by a proportional power sensing/limiting control circuit. This circuit automatically limits the maximum reflected power to a level equivalent to that realized with rated power output when the output VSWR ratio exceeds a preset level; 2:1 for most models. The amplifier may also be programmed to shut down when this ratio is exceeded.

Indication: blinking, red LED

*off -- safe
*red -- reflected power exceeding the pre-set level or amplifier has shut down if so programmed.

Control: [VSWR][RESET]AUTO/MAN alternate action push button switch

AUTO position -- automatic reflected power/output power limiting

MAN position -- amplifier shuts down when reflected power exceeds set limit. Button must be depressed twice to reset system.

Automatic Level Control : The ALC allows the amplifier to be adjusted for a predetermined output level to be maintained while the input may vary by as much as 20 dB above the minimum input required to obtain the desired output. The response time of the ALC may be selected to be fast or slow to suit the particular application. For modulated signals the slow mode should be selected; fast for CW. **Not recommended for pulse operation.**

Indication: red LED

*off -- no ALC action

*red -- ALC active. If the indicator is lit with the ALC control in the full clockwise position, ALC OFF, the amplifier is being overdriven.

Controls:

[ALC]-[MODE]-FAST/SLOW alternate action push button switch.

[RF OUTPUT POWER]-LEVEL SET linear potentiometer marked ALC OFF in full clockwise position.

Input Blanking : Input to the amplifier may be blanked by pushbutton operation. In this mode gate bias to the power amplifier devices is off, significantly reducing power consumption and heat generation.

Indication: red LED

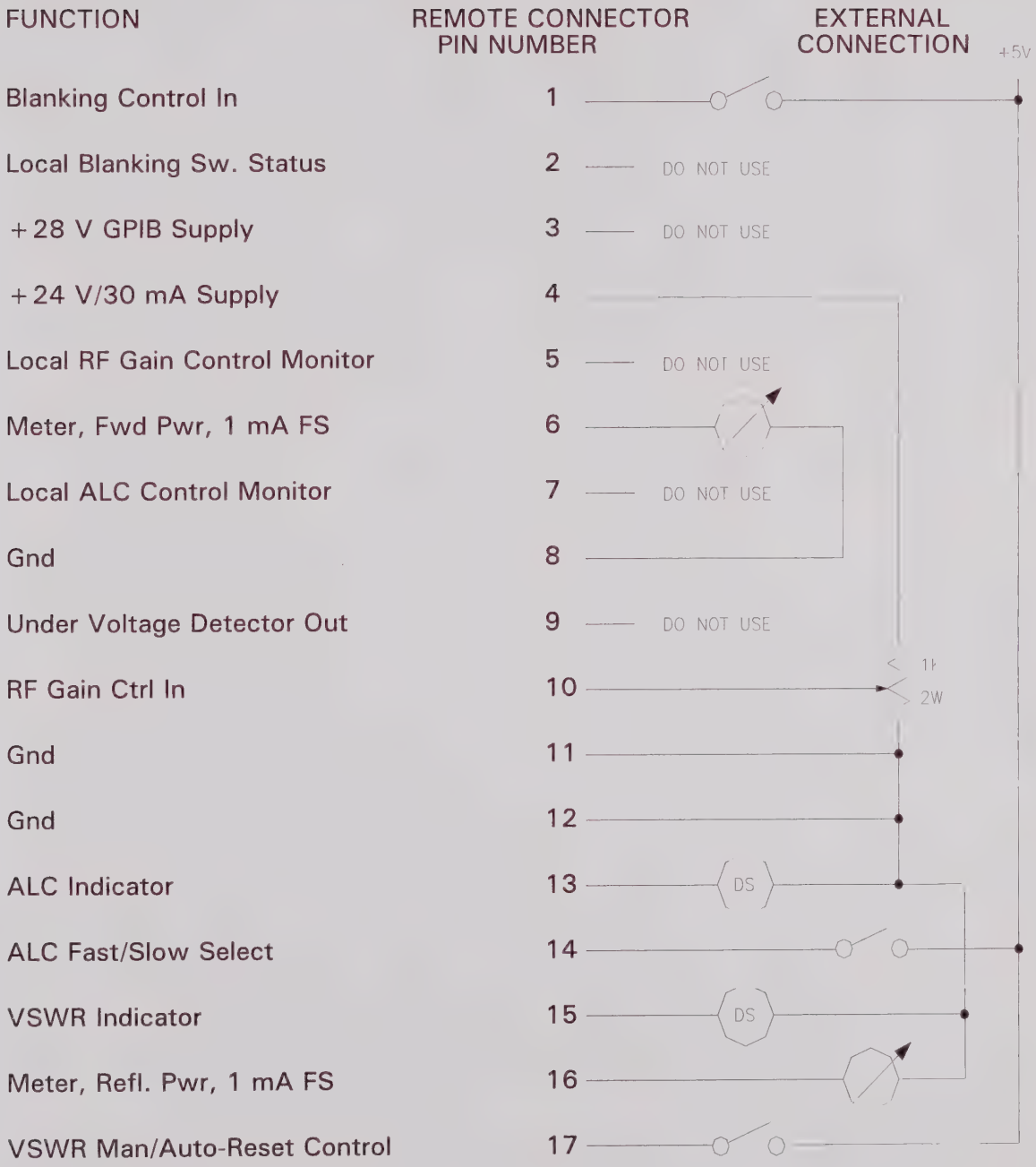
*off -- input active
*red -- input blanked

Control: [RF CONTROL]BLANKING on/off.Alternate action pushbutton; in = blanked.

RF Power Meter : The amplifier has a front panel-mounted, analog power meter, calibrated in WATTS FORWARD.

Remote Control : all functions, including power on/of, may be activated from a remote location with connections made through the 25-pin D-subminiature connector mounted on the rear panel. Remote control may be hard wired or with the Kalmus, Model IF488, IEEE488/RS232 INTERFACE.

Indication: yellow LED. May be lit from remote control panel to indicate that unit is under remote control. Local rf gain and ALC are disabled under hard-wired remote control as well as VSWR mode selection, ALC mode selection and blanking.

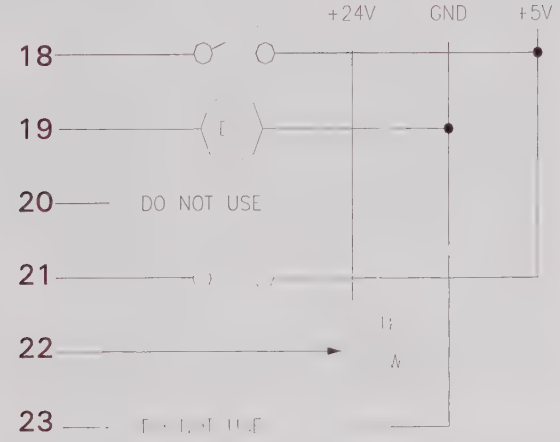


cont'd next page

Figure 1 -- Input/Output Diagram Remote Connector

FIGURE 1 cont'd

FUNCTION	REMOTE CONNECTOR PIN NUMBER	EXTERNAL CONNECTION
Remote Active Indicator	18	
Temperature Fault Indicator	19	
Local Control Lockout	20	DO NOT USE
Band Select	21	
ALC Control	22	
Power Supply Fault Out	23	
AC Power ON/OFF Ctrl (+)	24	
AC Power ON/OFF Ctrl (-)	25	



For remote operation the local power switch must be left in the ON position. 0 to 0.5 V, short circuit, or open circuit between pins 24 and 25 turns unit on. + 2.4 to + 5 V turns unit off.

Mating Connector:

Connector, Amphenol# DB25P - KEI Part Number 7-19-047-025

Shell/Strain relief, Alpha# FIT25 - KEI Part Number 7-19-103-025

Figure 1 -- Input/Output Diagram Remote Connector

Optional Equipment

The Kalmus Model IF488 interface option is used to provide either IEEE488 or RS232 control of all LA-series, single and dual-band amplifiers, front panel functions.

The interface will provide full remote control of the amplifier and the selective enabling or disabling of certain front panel controls such as the RF gain and ALC controls.

The RS232 interface uses 19, simple English commands to control the front panel functions. Any command issued without a value or argument will cause the interface to respond with the current value or condition. RS232 baud rates from 300 to 9600 may be selected with a rear panel switch. If the controlling system does not require the RS232 commands to be echoed from the interface RS232 output, a simple command will disable the echo feature. Fault conditions such as over-temperature or excessive VSWR will generate an English fault message.

The IEEE488 interface uses 24, 3-character commands to control the front panel functions of the LA-series amplifiers. As in the RS232 interface, certain front panel functions such as RF gain and ALC level may be selectively enabled during remote operation.

Commands that request operating conditions or values will generate a service request to the controller. When the talk function is enabled, the interface will provide the requested data. Fault conditions will also generate a service request to the IEEE488 controller followed by the fault condition. The IEEE488 address is selected by rear panel dip switches.

The interface front panel controls are the power switch and indicator, remote active indicator and IEEE488 addressed indicator.

Both the RS232 and IEEE488 controls may be used simultaneously if desired.

The LA series interface is housed in a standard, 3 1/2 inch high, 19-inch rack-mounted enclosure, 13 inches deep. Required power is either 120 VAC or 240 VAC, 35 Watt, selected at the rear panel.

1.3 Circuit Description

(See Interconnection Diagram 7-38-345-000, page 42.)

An rf input signal applied at J1 is directed to either the Low-Band Amplifier, 210L (A5), or the High-Band Amplifier, 720FL (A1), as directed by coaxial relay K3. Similarly, the selected amplifier output is directed to the output connector J2 via coaxial relay K2. These relays are operated simultaneously by band select switch S3 on the front panel.

The output of the amplifier modules is coupled to the output connector via bi-directional coupler A9 or DC1 depending on which band has been selected. These provide rectified samples of the forward and reflected power present at the output.

The sample outputs are applied to the power control circuitry, A3 and A4 via control relays A2K13 and A2K14 on the front panel pcb. Trimming potentiometers A2R27 and A2R28 adjust the output of the low band coupler to the same level as that of the high band coupler for the same output power level. This allows the control boards to operate for both bands without significant performance differences.

The VSWR protection circuit operates on the principle of maintaining a pre-set level of maximum allowable reflected power. Thus, under any amount of mismatch the amplifier will provide output without exceeding the amount reflected that can be tolerated. The VSWR circuitry provides a dc bias voltage to a pin-diode attenuator in the amplifier input circuitry which is proportional to the amount of reflected power, thus controlling the amount of input drive.

The amplifier modules have a bias disable line by which the bias of the output devices, and one or more of the predriver devices of the amplifier which is not selected, is disabled in order to reduce the current drain on the power supply.

The amplifier modules are fitted with normally closed temperature sensing switches calibrated to operate at 160 °F. These switches operate the blanking circuitry to remove the rf drive from the amplifier and the gate bias from the devices in the final amplifier in case of an over-temperature condition. After an over-temperature shutdown, operation will automatically resume after the temperature has returned to about 130 °F.

The following subassemblies are used in the Model 737LC and are described in some detail below:

A. Amplifier Module 210L, A5
B. Amplifier Module 720FL, A6
C. Power Control Circuit, A2-A4, A9 and DC1
D. Power Supply, PS1

A. Amplifier Module 210L, A5

(See Schematic 7-35-516-000, page 52.)

The low band amplifier consists of a four stage MOS-FET RF amplifier contained on a single P.C. board. The input signal is applied to the first stage via a pin-diode attenuator circuit, D5 through D10. This circuit provides variable attenuation on the input signal as a function of the forward bias which is under the control of the system's power control circuitry. It may also be adjusted from the front panel with the rf gain control potentiometer. Typical range is 20 dB.

The hybrid amplifier chip A1 assures a good input match. The signal is amplified by about 12 dB by Q1 which has also some feedback in the drain-gate circuit for stability. High frequency compensation is accomplished through C4/C5/C39-R48/C30. The output is passed on to the gate of Q2. Frequency compensation is provided by R14/C9/R18-L3. Additional compensation is provided by C10/C11/R19/R20 in the source circuit. A small amount of low frequency attenuation is provided at Q3 by R26-C17-R47/L5. C20 and C21 are coupling capacitors for the final stage input circuit.

The final stage is matched to the Q3 driver with transformer T1. This transformer is a coaxial-type, ultra-broadband ferrite type transformer, also serving as a phase inverter in this push-pull circuit. The bias regulator D2 sets the voltage to R31 at a fixed 10 Volts. R31 is used to adjust the drain current through Q4/Q5 to 1.5 Amperes for each FET. R39 is adjusted for best harmonic balance. C33 and C44 are high frequency peaking capacitors. Low frequency attenuation is provided through the drain to gate feedback circuits in Q4 and Q5. Inductors L10 and L13 are located off the P.C. board. This amplifier does not require any adjustments other than bias after transistor replacement. When the low band amplifier is not in use the bias to the final output devices is shunted to ground to reduce current drain from the supply. This is accomplished with relay A2K17 on the front panel board which grounds the bias disable line of the unselected amplifier.

B. Amplifier Assy 720FL, A6

(See Schematic 7-35-658-000, page 45.)

The amplifier module consists of four stages of pre-amplification and four, combined, push-pull final stages. The first stage is a hybrid amplifier chip, U1, providing about 6 dB of amplification and a good input match. The remaining pre-amplifier stages are MOS-FETs; the push-pull stages consist of two, quad MOS-FET devices. A hot-carrier diode attenuator, CR1, follows the first stage, which is used to control the gain of the amplifier automatically from the power control circuitry as described above for the lo-band amplifier.

C. Power control circuitry, A2 - A4, A9 & DC1

The power control circuitry performs the following functions, some of which are pre-set at the factory, others may be selected and/or adjusted from either the front panel or an optional remote control facility:

* Automatic Forward Power Level Control (ALC)
* Automatic Reflected Power Level Control (VSWR Protection)
* RF Gain Control
* Input Blanking
* Over-Temperature Protection
* Overdrive Protection
* Manual/Automatic Mode Selection (VSWR Protection)
* Forward Power Indication
* Reflected Power Indication
* Overdrive/ALC Indication
* VSWR Status Indication
* Over-Temperature Indication

The Power Control Circuitry consists of Front Panel PCB Assy, A2; Reflected Power Control PCB Assy, A3; Forward Power Control PCB Assy, A4; a Remote Function Harness Assy, and Power Sensor DC1. A brief description of each assembly is given below, followed by a more detailed explanation of the power control circuit operation.

1. Front Panel PCB Assy, A2

(See Schematic 7-35-730-000, page 47.)

The Front Panel PCB Assebly houses all controls (except the RF Gain and ALC controls), indicators and power meter, associated with the power control functions. The Forward Power Control PCB Assy, A4, and the Reflected Power PCB Assy, A3, plug in directly to the Front Panel PCB Assy. It further provides all interconnections to the remote connector. A 24 Volt regulator circuit, VR1, provides a stable supply for the power control circuitry.

The circuit consisting of U1 and U2 and associated components constitutes an Under Voltage Detector. It compares the system 28 Volt supply with the 24 Volt control circuit supply and trips the blanking circuit if the 28 Volt disappears as a result of an over-temperature condition on critical parts of the amplifier, or when the voltage drops as a result of excessive current demand from the supply. An over-temperature is indicated by normally closed temperature sensing switches located at strategic points in the amplifier which open when activated by temperatures over 160 °F. This interrupts the 28 Volt to the Under Voltage Detector. Excessive current demand may be caused by too much rf input drive or device failure. The trip level for this detector is adjusted with R22 and is indicated by a green LED mounted directly on the pcb

but not visible from the outside of the unit. The trip level is adjusted to the point where this LED is lit. It should remain 'on' to indicate proper setting. C3 and R17 provide a delay to keep the system from acting too quickly.

Relays K1, K2 and K3 condition the front panel circuitry for either local or remote operation. They are controlled by Q1 which is 'on' for local operation, thus energizing K1 through K3. The contacts of these connect the local rf gain control , ALC control, VSWR auto/manual/reset switch, ALC fast/slow switch, band select switch and the blanking switch into the circuit for local operation. When the unit is to be operated remotely, pin 20 of the remote connector must be grounded to disable the local controls and connect the remote controls into the circuit when these are connected to the appropriate pins of the remote connector. This is shown in figure 1 on pages 9 and 10 and described in Section 3.4, REMOTE CONTROL FUNCTIONS AND INDICATORS. This is not necessary when the unit is operated via GPIB with the Model IF488, Interface Unit.

Output power indication is provided on a front panel-mounted, analog meter movement with the scale calibrated in Watts forward power. Power indication is for indicating purposes only and has a typical accuracy of 10%.

2. Reflected Power Control PCB Assy, A3

(See Schematic 7-35-721-002, page 50.)

This assembly plugs in directly to the front panel pcb assembly. It functions in conjunction with the Forward Power Control PCB Assy to provide a control voltage for the PIN-diode attenuator in the input circuit of the driver amplifier. U4A amplifies the dc sample voltage from the power sensor. Jumper JP2 is a coarse gain selection device to accommodate the various types of power sensors used with this circuitry. Voltage follower U4B provides the drive for the front panel meter and remote meter. R1 calibrates the front panel meter. U4C is the ALC level comparator with R4 the reference set control. The output of the ALC level comparator drives the PIN-diode via voltage folllower U4D and either Q4 emitter follower for series-diode attenuators or inverter Q5 for shunt diode attenuators as determined by jumpers JP5 and JP6.

Comparator U6 provides the drive for the front panel and remote indicators.

U1 provides a +12 Volt source for dc to dc converter U2 which develops a -9 Volt source for regulator U3. U3 provides a -5 Volt source for operational amplifiers U4 and U6. The control for the shunt-type PIN-diode attenuator is present at J1-4; for the series-type attenuator at J1-8. Relay K1 selects either AUTO or MANual mode for the VSWR protection function as selected.

3. Forward Power Control PCB Assy, A4

(See Schematic 7-35-721-001, page 49.)

The Forward Power Control PCB Assy is in essence identical to the Reflected Power Control PCB as described above. The difference is that the control output of this circuit is applied to the Forward Control Input of the Reflected Power Control PCB from where it is added with the output of the Reflected Power Control Circuit via D1 and Q3. The combined outputs affect the PIN-diode attenuator to maintain a pre-set safety level for reflected power as well as a pre-set amount of forward power as a function of the ALC control and or RF gain control.

U1 provides a +12 Volt source for dc to dc converter U2 which develops a -9 Volt source for regulator U3. U3 provides a -5 Volt source for operational amplifiers U4 and U6.

Relay K1 selects either the slow or fast mode for the ALC action as selected from the front panel.

4. Power Sensor

The heart of the power control circuitry is the power sensor or reflectometer which provides continuous sampling of the forward and reflected power on the output of the amplifier.

The sample outputs, which are approximately 50 dB coupled, are, depending on the frequency range of the unit, rectified either internally or by diode detectors D1 and D2. These are applied to the forward and reflected power control boards via the front panel board.

5. Control Circuit Operation

The output power of the amplifier passes through the power sensor which provides rectified sample outputs, approximately 50 dB down, of the forward and reflected output. These outputs are applied to the power control boards.

The Forward and Reflected Power Control Circuitry establishes a feedback path to limit the output power of the amplifier to safe levels during operation in overdrive and VSWR conditions, thus preventing damage to the amplifier. It further serves to limit the output level of the amplifier to a pre-set level with the front panel ALC control and provides overall rf gain control from the front panel. The complete control loop consist of the power sensor or reflectometer, the two power control cards, and a PIN-diode attenuator.
The PIN-diode attenuator circuit is generally integrated with the amplifier circuitry on the amplifier pcb assembly, either directly at the input or

following the first stage. Depending on frequency, this diode attenuator is either a shunt-type or a series-type. Except for pulse amplifiers, amplifiers operating at frequencies below 1 MHz use the shunt-type, others the series-type.

The shunt-type attenuator shunts the incoming rf signal to ground as a function of the forward bias applied to the diodes. The greater the amount of forward bias, the greater the attenuation of the input signal. This attenuator has the inherent drawback of providing typically no more than 20-25 dB attenuation, however the series-type attenuator, which provides in excess of 30 dB attenuation, introduces unacceptable amounts of harmonic distortion on lower frequency signals.
The series-type attenuator reduces the incoming rf signal as a function of the amount of forward bias applied to the diodes. The smaller the amount of forward bias the greater the attenuation.

The control circuit is configured to operate in two modes to either control the amplifier gain via a series-type PIN-diode attenuator or a shunt-type as required by the amplifier configuration. In the dual-band amplifier systems both options are used; shunt configuration for the low band and series for the high band. Relay switching on the front panel board as a function of the band select switch connects the control boards to either the low or high band coupler and selects the shunt or series mode operation.

The following applies to both the reflected and forward power control boards.

During normal operation, where the ALC control and RF gain controls are set fully clockwise, and the amplifier is delivering power into a 50 Ohm load, ALC level set comparators are providing maximum positive output. This comparator output from the Forward board is presented at the cathode of D1 of the Reflected board via voltage follower U4D, JP7, J1-8 of the Forward board, and J1-7 of the Reflected board. This places Q3 at the borderline of conducting. The comparator output of the Reflected board is applied to the PIN-diode attenuator of the amplifier via voltage follower U4D, and depending on which type of PIN-diode, shunt or series, via inverter transistor Q5 or emitter follower Q4. Shunt vs. series is selected with jumper plugs JP6 (shunt) or JP5 (series). Under these conditions the PIN-diode attenuator provides minimum attenuation on the input signal. Comparator U6 output is forced low, which cuts off Q1 and Q2 and hence the local and remote indicators are off, ALC for the Forward board and VSWR for the Reflected board.

*Automatic Level Control (ALC):

As the output of the FWD port of the power sensor increases, the output of U1 on the Forward board also rises. When this output exceeds the reference voltage at U4C-10 as set by the front panel

ALC control or R4, the output of U4C is reduced. This change is seen at D1 on the Reflected board since the output from the Forward board is returned to input connector, pin 7, of the reflected board. Q3 is caused to conduct and effectively shunts some of the input voltage to voltage follower U4D to ground. This in turn reduces the control voltage to the PIN-diode with as result reduced rf input. Any further increases in the reflectometer's output decreases the rf input more and a constant output is maintained from the amplifier as set by the ALC control.

The ALC response time is determined by the integrator capacitors C7 and C9 at U4C. K1, when activated by the front panel ALC mode switch, disconnects C9 for increased response time.

The reference level for comparator U6 is adjusted with R5 for a level that coincides with the change at the output of U4C when ALC action just begins to take place. As result the output of U6 changes state at that point forcing the output of U6 high. This turns on Q1 and Q2, providing local and remote ALC indication.

An additional function that affects the control voltage for the PIN-diode attenuator is the RF gain control. This control provides 0-24 Volt at pin 7 of the input connector of the Forward board and causes a reduction of the control voltage as Q3 shunts more or less of this voltage to ground as a result of this.

*VSWR Condition:

The Reflected Power Control Board operates in much the same way as the Forward Power Control Board. It receives its input from the REFLected output of the power sensor. The primary differences are that the reference level for the level set conmparator is not accessible for the user and is factory-set, and that the control voltage for the PIN-diode attenuator is passed either through an emitter follower or a transistor inverter to accommodate either the series or shunt-type diode attenuator. This is determined by jumper plugs JP6 and JP5. For single-band amplifiers the control voltage is taken from pin 8 of the connector and is either one or the other; for dual-band amplifiers both control voltage polarities are used.

The control voltage for shunt operation is present at pin 4 and for series at pin 8 for which JP5 is in place.

The feedback path consist of R23, CR3 and K1. K1 is controlled by the AUTO/MANual switch on the front panel of the instrument. Automatic reset is selected when K1 is open. In the MAN position K1 is closed and a positive voltage fed back from the VSWR indicator driver Q2 via D4 and R25 latches U4C in the fault mode

until the state of K1 is changed with the RESET button on the front panel.

6. Blanking

The input to the amplifier may be blanked, by operating the alternate action, BLANKING pushbutton switch, located on the front panel. An LED indicates red when the amplifier is being blanked; off when not blanked.

7. Power Meter

Output power indication is provided on a front panel-mounted, analog meter movement with scale calibrated in Watts forward power. These readings are for indication only with a typical accuracy of ±10%.

D. Power Supply

(See APPENDIX, page 53.)

The power supply of the Model 737LC is a commercial switching supply, Model LFS44-28, manufactured by Lambda Electronics, Melville L.I. NY 11747. The use of this supply eliminates the conventional power transformer with its associated heat, weight and large filter capacitors.

The AC power is supplied via an AC input module which accepts a standard IEC power plug and contains two 5 X 20 mm style rated 6 A.

Power on/off control is accomplished via K1 using a 24 Vac control voltage produced by transformer T1. This keeps dangerous line voltages from appearing around the front panel control circuitry.

2.0 Operation

2.1 General

Prior to installation and/or use of the instrument, a thorough visual inspection should be made to detect any shipping damage. The equipment is designed to withstand normal physical environments encountered during shipping, but occasionally damage can occur. If it does, it should be reported immediately. The reusable shipping container should be retained until the user is certain the equipment is performing to specification.

A. Cooling

It is essential that the 737LC forced-air cooling system be allowed to operate at maximum efficiency in order to maintain operation of the individual components within their ratings. Cooling is dependent upon the free flow of cooling air through the sides and rear of the unit. Therefore, care should be exercised to keep these areas free of any objects that could obstruct this free air flow.

B. Safety Precautions

There are no special safety precautions to be observed. Input to the unit should not exceed 1 Volt peak to peak. Damage due to output mismatch is avoided by the fast reacting protection circuitry which automatically limits or removes rf drive from the amplifier final stages until the output has been properly matched.

C. Connection To Power Source

The 737LC operates from either 95-132 VAC or 187-250 VAC, 50/60 Hz. This is not externally selectable. The unit is wired for the line voltage range specified at the time of order. To change this see par. D below.

The unit is connected to the power source with the line cord provided.

D. Line Voltage Selection

When a change in line voltage is required some internal wiring changes are to be made. It is necessary to remove the top cover from the unit and perform the following operations with reference to the instructions given in flagnote 4 on Wiring Diagram 7-38-345-000 on page 42.

*With reference to the Instruction Manual for the LFS44-28 supply appended to this manual and Wiring Diagram 7-38-345-000, flagnote 4, remove or install the wire jumper between terminals A and B as the case may require.

* With reference to the Wiring Diagram, flagnote 4, alter the jumpers on TB1 as required for the desired line voltage range.

3.0 OPERATION

3.1 Safety Precautions

PHYSICAL CONTACT WITH THE RF OUTPUT CONNECTION MUST BE AVOIDED AS PAINFUL RF BURN MAY RESULT

There are no other special safety precautions to be observed. Input to the unit should not exceed 1 Volt peak to peak. Damage due to output mismatch is avoided by the fast reacting protection circuitry which automatically limits or removes rf drive from the amplifier final stages until the output has been properly matched.

3.2 General

Operating this amplifier requires no special procedures. Observing the following is all that is necessary:

1. The amplifier must be connected to the AC power source as described above in Section 2.0.

2. The amplifier output must be connected to a suitable load using RG400/U or equivalent coaxial cable.

3. The rf input drive should not exceed +10 dBm. Exceeding this level will result in an overdrive condition.

4. Operate the system initially at a low input drive to verify proper operation, and then gradually increase the drive to full output power. Once proper operation has been established, this precaution is no longer necessary.

5. It is essential that the forced-air cooling system be allowed to operate at maximum efficiency in order to maintain operation of the individual components within their ratings. Cooling is dependent upon the free flow of cooling air through the front and rear of the unit. Therefore, care should be exercised to keep these areas free of any objects that could obstruct this free air flow.

3.3 Detailed Amplifier Operation

The operation of the amplifier is requires no more than an understanding of the functions of the front panel indicators and controls. These are described below and depicted in figure 2.

3.3.1 Front Panel Controls And Indicators

The Amplifier System has the following front panel controls and indicators.

[AC LINE]ON/OFF -- Alternate action pushbutton switch. Turns equipment on and off.

[AC LINE]SYSTEM -- Green LED. Indicates system power.

[RF CONTROL][BLANKING]ON/OFF -- Alternate action pushbutton switch. Inhibits the rf input to the amplifier. Switch action is indicated by a red LED above it; indication is off when the amplifier is not blanked; red when blanked.

[RF BAND][SELECT]LOW/HIGH -- Alternate action pushbutton switch to select desired frequency band. Selected band is indicated by green LED's.

CAUTION!- Do not operate bandswitch without removing input drive. Operate blanking switch first. Switching under full power will damage the coaxial relays.

[ALC][MODE]SLOW/FAST -- Alternate action pushbutton switch to select either the slow or fast response of the ALC action to incoming signal level changes. Use FAST mode for CW type signal; SLOW for AM modulated type signals. **Not recommended for pulse type signals.**

[ALC][MODE] -- Red LED. Indicates when ALC action is taking place.

[VSWR][RESET]AUTO/MAN -- Alternate action pushbutton switch to select AUTOmatic or MANual mode for the operation of the power control circuitry. When the system operates in the manual mode, this pushbutton performs the RESET function after a VSWR trip condition. The button must be depressed twice for reset and return to the manual mode.

[VSWR] -- Red, blinking LED. Indicates red when load VSWR exceeds 2:1.

[FAULT]TEMP -- Red, blinking LED. Indicates when the amplifier heatsink temperature reaches 160 degrees F. The amplifier shuts down. Operation will resume when the temperature returns to normal, approximately 130 degrees F, and if no failure has occurred.

[REMOTE ACTIVE] -- Red LED. May be turned on from a remote location to signal that the amplifier is under remote control and local controls are inactive. When the IEEE488 Interface is controlling the amplifier, this indicator will be on.

[RF SIGNAL INPUT]GAIN -- Linear potentiometer control providing approximately 0 - 30 dB attenuation on the input signal.

[RF OUTPUT POWER]LEVEL SET -- Linear potentiometer control. Controls the ALC action and allows the output to be adjusted to a desired constant level. Full clockwise position, ALC OFF, removes ALC action.

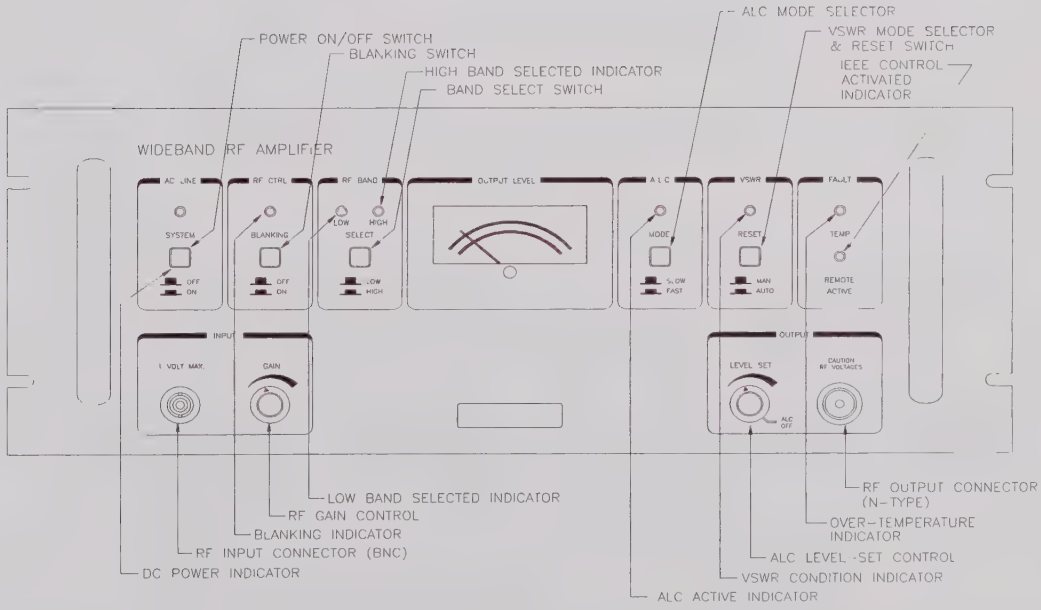


Figure 2. Front Panel Controls & Indicators

3.4 Remote Control Functions And Indicators

The amplifier may be operated from a remote location and status indications provided via the remote interface connector located on the rear panel of the unit. The Input/Output Diagram for this connector is shown on pages 9 and 10, Figure 1. Only those in **bold** type are for user access.

BLANKING CONTROL IN -- +5 Volt(25 mA nom.) applied to pin 1 operates the blanking relay on the front panel pcb which inhibits the input signal.

LOCAL BLANKING SWITCH STATUS -- Pin 2. Not a user remote function. Do not connect.

+28 VOLT GPIB SUPPLY -- +28 Volt available at pin 3 to supply certain control functions in the optional KEI GPIB Interface Unit.

+24 Volt SUPPLY -- 24 Volt is available at pin 4 to supply the remote ALC control and RF gain control. Total current drain should be limited to 50 mA maximum. There is no internal current limit, therefore care should be taken not to short circuit this pin 4. No damage will occur if shorted, but operation of the power control circuitry will be impaired.

LOCAL RF GAIN CONTROL MONITOR -- Pin 5. Not a user remote function. Do not connect.

METER, FORWARD POWER -- pin 6 provides an output corresponding to the forward power level output. The level is intended to drive a 1 mA full-scale meter movement.

LOCAL ALC CONTROL MONITOR -- pin 7. Not a user remote function. Do not connect.

UNDERVOLTAGE DETECTOR OUT -- Pin 9. Not a user remote function. Do not connect.

RF GAIN CONTROL IN -- Pin 10. The remote control should be a 1000 Ohm, 2 Watt, linear potentiometer. It must be connected as shown in figure 1. The dc voltage on the wiper should increase with clockwise rotation.

ALC INDICATOR -- Pin 13. Provides a high level TTL signal when the input drive level of the amplifier is sufficiently high to force ALC action as adjusted with the ALC control. Supply is 25 mA maximum. The output at this pin goes low when the input drive level does not force ALC action.

ALC FAST/SLOW SELECT -- Pin 14. A +5 Volt @ 25 mA level switches in the fast mode; 0 Volt or open is slow mode.

VSWR INDICATOR -- Pin 15. Provides a high level TTL signal, 25 mA maximum, when the output mismatch exceeds a ratio of 2 to 1.

METER, REFLECTED POWER -- Pin 16. Provides an output corresponding to the reflected power level at the output. The level is intended to drive a 1 mA full-scale meter movement.

VSWR MAN/AUTO-RESET CONTROL -- Pin 17. A +5 Volt @ 25 mA level activates the AUTO protection mode; 0 Volt or open is MANUAL mode. To reset the amplifier after a VSWR trip condition, a momentary +5 Volt level must be applied to return to the MANUAL mode.

REMOTE ACTIVE INDICATOR -- Pin 18. A +24 Volt @ 20 mA level lights the indicator on the front panel to indicate that the amplifier has been placed under remote control.

TEMPERATURE FAULT INDICATOR -- Pin 19. Provides a high level TTL signal when the temperature of the amplifier heatsink exceeds 160 degrees F. Supply is 25 mA maximum. The output is low with normal temperature.

LOCAL CONTROL LOCKOUT -- Pin 20. This line must be forced low by connection to ground at pin 8,11 or 12 to disable the local controls when remote control is used.

BAND SELECT -- Pin 21. A +5 Volt @ 20 mA level changes the band selection.

ALC CONTROL IN -- Pin 22. The remote control should be a 1000 Ohm, 2 Watt, linear potentiometer. It must be connected as shown in figure 1. The dc voltage on the wiper should increase with clockwise rotation.

GROUND -- Pins 8, 11, 12.

AC POWER ON/OFF CONTROL -- Pin 24 and Pin 25 provide for the remote power on/off control of the amplifier. For this control to function the amplifier AC LINE switch must be left on. To turn the amplifier off, a TTL high signal must be applied between pins 24 and 25, with the positive to pin 24. An open circuit or short circuit condition between pins 24 and 25 turns the amplifier on.

3.5 Placing Equipment In Service

It is good practice to follow the procedure below for placing the equipment in service:

a. Make sure equipment is connected to the appropriate power source.

b. Make sure appropriate load is connected. Impedance should be approximately 50 Ohm resistive and power rating should be at least that of the rated output power of the amplifier.

c. Without signal applied to the input, switch the AC LINE switch to the ON position. The front panel power indicator will come on and the fans will start.

NOTE: all indicators should be off except the ac power indicator. If the blanking indicator is lit depress the blanking button to turn it off.

d. Apply an input signal within the frequency range of the amplifier and slowly increase the drive level until rated output power is achieved.

3.6 Fuses

Two, 16 A, 5 X 20 mm-style fuses are located in the ac input module on the rear panel.

4.0 MAINTENANCE

4.1 General

No maintenance is required except for the occasional cleaning of the fan openings of the amplifier.

5.0 ITEMIZED PARTS LIST

The Itemized Parts List provides a breakdown of the equipment covered by this manual. Illustrations are limited to the assy drawings of the individual sub-assemblies. The breakdown is by assy and all part numbers are in-house identification numbers. Generally all parts are available from stock and may be ordered from:

KALMUS

21820 87TH SE

WOODINVILLE, WASHINGTON 98072

Telephone (206) 485-9000

FAX (206) 486-9657

PARTS LIST
FOR
RF POWER AMPLIFIER, MODEL 737LC
PART NUMBER 3-60-425-001

REF DESIGNATOR	QTY	DESCRIPTION	PART NUMBER
A2	1	PCB ASSY FRONT PANEL 2-BAND	4-30-380-001
A3	1	PCB ASSY PWR CTRL REFL	4-30-377-002
A3 A4	2	STANDOFF 1/4 RD 4-40 X 5/16	7-51-007-005
A4	1	PCB ASSY PWR CTRL FWD	4-30-377-001
A5	1	AMP ASSY 210L-STYLE 25W	4-62-175-001
A6	1	AMP ASSY 720FL 200-1000MHZ 25-50W	4-62-186-002
A8	1	CABLE ASSY RIBBON LA-SERIES	4-68-205-001
A9	1	DC25DL BI-DIR. COUPLER	4-65-191-002
	1	FILTER ASSY FAN NOISE	4-65-232-001
B1 B2	2	GUARD FINGER PLASTIC	7-18-206-001
B1 B2	2	FAN DC GENERAL USE 24VDC 100CF	7-18-207-001
C1 C2	2	CAPACITOR CER DISC 1KV .01UF	7-03-401-103
DC1	1	POWER SENSOR 25W 200-1000MHZ	7-27-036-005
F1 F2	2	FUSE 5mm X 20mm TYPE F 6.3A	7-13-105-063
J1	1	ADAPTER BNC/BNC JACK	7-19-011-001
J2	1	CONNECTOR BARREL "N" TYPE	7-19-022-001
J3	1	FUSE DRAWER W/O VOLT SEL INSERT	7-14-007-002
J4	1	MODULE POWER ENTRY	7-19-058-001
K1	1	RELAY 1PDT 24VDC	7-17-010-001
K2	1	SOCKET	7-15-008-001
K3 K2	2	RELAY COAXIAL	7-17-015-001
M1	1	METER PANEL 25 WATT FS	7-25-013-026
MATE FOR J3	1	CONNECTOR D-SUBMIN 117D SERIES	7-19-047-025
P1 P5 P6 P8	25	TERMINAL CRIMP 2759 SERIES M	7-19-003-001
P1 P8	2	HOUSING CONNECTOR 10 POS	7-19-002-010
P3	1	CONNECTOR POWER RECEPT 6 POS	7-19-016-006
P4	5	CONNECTOR PIN RECEPT	7-19-005-001
P5 P6	2	HOUSING CONNECTOR 4 POS 22-01-10	7-19-002-004
PS1	1	POWER SUPPLY REG 28V 11.5A LFS44-28	7-28-007-028
R1 R2	2	POTENTIOMETER S-TAPER 2W 1K	7-02-002-102
R3	1	RESISTOR CF 1/2W 2.7K	7-01-202-272
R4	1	POTENTIOMETER TRIMMING 1T 1/2W	7-02-010-501
T1	1	TRANSFORMER CONTROL	7-44-039-001
	1	SOCKET 10A 300VF	7-15-008-002
	1	SOCKET RELAY 3PDT	7-15-008-003
	2	CLIP HOLD-DOWN RELAY (SET)	7-15-012-001
	1	RELAY 24VAC 3PDT	7-17-018-001
	1	CONNECTOR BNC ANGLE PLUG CRIMP	7-19-059-001
	1	CONNECTOR BNC STRAIGHT/CRIMP 50 OHM	7-19-060-001
	1	CONNECTOR BNC PLUG RG188	7-19-060-002
	3	CONNECTOR N PLUG 90 DEG.	7-19-061-001
	6	CONNECTOR SMA PLUG 90 DEG.	7-19-063-001

REF DESIGNATOR	QTY	DESCRIPTION	PART NUMBER
	2	CONNECTOR SMA PLUG	7-19-064-001
	1	SCREWLOCK FEMALE D20418-2	7-19-093-001
	1	BOOT HEATSHRINKABLE STRAINRELI	7-19-103-025
	1	CONNECTOR D-SUBMIN 7W2S	7-19-139-001
	2	CONTACT HIGH POWER #12S	7-19-140-001
	1	TERMINAL STRIP	7-20-008-003
	2	TERMINAL STRIP HH SMITH 866	7-20-008-005
	1	TERMINAL STRIP 2-POS	7-20-034-002
	2	HANDLE BLACK	7-21-001-001
	2	KNOB 1/4" ALCO #KNS501BA	7-21-006-001
	4	RUBBER FEET #10 SCREW	7-23-002-002
	2	CORE SLEEVE FERRITE	7-24-028-001
	2	RF DET POS OUTPUT	7-27-017-001
	1	CORD LINE BLACK W/2 PLUGS	7-29-205-018
	1	BASEPLATE 737LC	7-40-010-001
	1	SIDE PANEL RH 5.25"	7-40-083-001
	1	SIDE PANEL LH 5.25"	7-40-083-002
	2	BRACKET MTG 5.25"	7-40-084-001
	1	LABEL MODEL 737LC	7-40-086-030
	1	BRKT PCB MNT REFL PWR CTRL	7-40-090-001
	1	BRACKET MTG AC FILTER	7-40-105-002
	1	COVER TOP	7-41-380-001
	1	AIRDUCT	7-41-453-001
	1	AIRDUCT	7-41-453-002
	1	CHANNEL BOTTOM AIR DUCT	7-41-454-002
	2	COVER	7-41-455-001
	2	MOUNTING RAIL RELAY (RAW STOCK)	7-41-530-001
	1	BRACKET SWITCH MTG	7-41-571-001
	1	PANEL REAR LA100/200 SERIES	7-41-892-001
	1	PANEL FRONT DUAL BAND AMPLIFIER	7-41-988-002
	1	HEATSINK 720F (742059/102)	7-43-094-001
	2	WASHER FLAT SS FLAT 1/4I	7-50-003-250
	3	WASHER LOCK SPLIT SS 1/4ID	7-50-005-250
	1	SCREW 1/4-20 1" ROUND SLOT	7-50-008-016
	2	NUT HEX 1/4-20	7-50-009-250
	10	STANDOFF 1/4" RND 4-40 AL	7-51-007-004
	8	STANDOFF AL 1/4 RND x 3/4" 4-4	7-51-007-012
	2	PLUG HOLE 1/2 INCH	7-51-061-008
	1	PLUG HOLE 5/8 INCH	7-51-061-010
	3	LABEL EARTH PER DIN 40712 Nr.33	7-97-015-001

REF DESIGNATOR	QTY	DESCRIPTION	PART NUMBER
A2		**PCB ASSY FRONT PANEL DUAL BAND**	**4-30-380-001**
C1 C2	2	CAPACITOR CER 50V Z5U 1UF	7-03-502-105
C3	1	CAPACITOR ELECTR AXL 35V 220MF	7-03-702-227
C4 C5	2	CAPACITOR CER 50V Z5U .47UF	7-03-502-474
D2	1	DIODE ZENER 1W 5% 5.1V 1N4733A	7-06-001-951
D3 D4 D5 D6 D8 D9 D10 D11 D12 D13 D14	11	DIODE RECT 1A 140PIV 1N4003	7-06-002-003
D7	1	DIODE ZENER 18V 5% 1N5355B	7-06-027-018
DS8	1	LED 5MM DIA DIFFUSED GREEN 565nm	7-12-002-002
J1 J2 J3 J4 J8	5	HEADER PCB 10-PIN	7-19-006-010
J5	1	HEADER PCB 22-23-2121	7-19-006-012
J6 J7	2	HEADER PCB 4-PIN	7-19-006-004
J9	1	HEADER 3-PIN	7-19-095-003
J9	1	HEADER JUMPER GOLD CONTACT	7-19-097-001
K1 K2 K3	3	RELAY JWD 171-28 24V	7-17-003-003
K4 K5 K8 K9 K10 K11 K12 K13 K14 K16 K17	11	RELAY REED JWD 172-8 24V	7-17-003-002
K6	1	RELAY REED 24 VDC NO DIODE	7-17-003-004
K7 K15 K18	3	RELAY JWD172-5	7-17-003-001
Q1	1	TRANSISTOR GP NPN 2N4400	7-07-030-001
Q2	1	TRANSISTOR PWR NPN GP 13003	7-07-112-001
Q3 Q4	2	FET GP VN10KMT VN10KM	7-07-001-001
R1	1	RESISTOR CF 5% 1W 1.5K	7-01-203-152
R10 R11	2	RESISTOR CF 1/4W 1 OHM	7-01-201-109
R12	1	RESISTOR CF 1/4W 5.6K	7-01-201-562
R13 R14 R15 R16	4	RESISTOR CF 1/4W 10K	7-01-201-103
R19	1	RESISTOR CF 1/2W 750 OHM	7-01-202-751
R22	1	POTENTIOMETER TRIMMING 15T 1W 10K	7-02-005-103
R23 R26	2	RESISTOR CF 1/4W 12 OHM	7-01-201-120
R24	1	RESISTOR MF 2W 560 OHM	7-01-304-561
R25	1	RESISTOR CF 1/2W 620 OHM	7-01-202-621
R27 R28	2	POTENTIOMETER TRIMMING 15T 1W 100K	7-02-005-104
R29	1	RESISTOR CF 1/2W 2K	7-01-202-202
R3 R21	2	RESISTOR CF 1/4W 180 OHM	7-01-201-181
R30	1	RESISTOR CF 1/2W 560 OHM	7-01-202-561
R32 R33	1	RESISTOR CF 1/4W 270K	7-01-201-274
R34	1	RESISTOR CF 1/4W 30K	7-01-201-303
R4 R18 R20 R31	4	RESISTOR CF 5% 1W 1.2K	7-01-203-122
R6 R17	2	RESISTOR CF 1/4W 1K	7-01-201-102
R7	1	RESISTOR CF 1/4W 4.7K	7-01-201-472

REF DESIGNATOR	QTY	DESCRIPTION	PART NUMBER
R8	1	RESISTOR CF 1W 330 OHM	7-01-203-331
S1 S2 S3 S4 S5	5	SWITCH PUSHBUTTON	7-16-013-001
U1 U2	2	IC OP AMP #LM741CN	7-08-001-001
VR1	1	IC REGULATOR VOLTAGE 24V MC7824CT	7-08-013-008
	5	CAP PUSHBUTTON GRAY	7-16-032-003
	1	PWB FRONT PANEL ASSY DUAL-BAND	7-30-380-001
	1	HEATSINK	7-43-004-001

REF DESIGNATOR	QTY	DESCRIPTION	PART NUMBER
A3		**PCB ASSY PWR CTRL REFL**	**4-30-377-002**
C1	1	CAPACITOR PORC CHIP ATC100 100PF	7-03-411-101
C11 C12 C13 C14	4	CAPACITOR CER 50V Z5U .01UF	7-03-502-103
C2 C3 C4 C5 C6 C10	6	CAPACITOR ELECTR AXL 50V 10MF	7-03-706-106
C7	1	CAPACITOR CER 50V Z5U .033MF	7-03-502-333
D1 D4 D5 D6	4	DIODE SIGNAL 1N4148	7-06-003-001
D2	1	DIODE ZENER 1W 5% 4.7V 1N4732A	7-06-001-947
J4 J5	2	HEADER PCB 22-23-2121	7-19-006-012
JP1 JP2 JP4 JP5 JP6 JP8	6	HEADER JUMPER GOLD CONTACT	7-19-097-001
JP1 JP2 JP4 JP5 JP6 JP8 JP7	6	HEADER PCB 2-PIN	7-19-095-002
Q1 Q2	2	FET GP VN10KMT VN10KM	7-07-001-001
Q3	1	TRANSISTOR GP PNP 2N3906	7-07-125-001
Q4	1	TRANSISTOR GP NPN 2N4400	7-07-030-001
Q5	1	TRANSISTOR GP PNP 2N4402	7-07-022-001
R1 R4 R5	3	POTENTIOMETER TRIMMING 15T 1W 10K	7-02-005-103
R11	1	RESISTOR MF 2W 1.8K	7-01-304-182
R16	1	RESISTOR CF 1/4W 5% 470K	7-01-201-474
R17	1	RESISTOR CF 1/4W 510K	7-01-201-514
R18	1	RESISTOR CF 1/2W 510 OHM	7-01-202-511
R19	1	RESISTOR CF 1/2W 10K	7-01-202-103
R2 R3	2	RESISTOR CF 1/4W 5.1K	7-01-201-512
R21	1	RESISTOR CF 1/4W 18K	7-01-201-183
R22	1	RESISTOR CF 1/4W 1K	7-01-201-102
R25 R12	2	RESISTOR CF 1/4W 2K	7-01-201-202
R27	1	RESISTOR CF 1/4W 24K	7-01-201-243
R6 R10 R14 R26 R23 R24	6	RESISTOR CF 1/4W 10K	7-01-201-103
R7	1	RESISTOR CF 1/4W 15K	7-01-201-153
R8 R9 R15	3	RESISTOR CF 1/4W 47K	7-01-201-473
U1	1	IC REGULATOR 12V MC7812CT	7-08-013-004
U2	1	IC DC-DC CONVERTER ICL7662CPA	7-08-019-002
U3	1	IC VOLTAGE REG -5V MC7905CT	7-08-025-001
U4 A B C D	1	IC OP AMP MC34074P	7-08-038-001
U5	1	IC OP AMP LM111J8 OR PM111Z	7-08-034-001
	1	RELAY JWD172-5	7-17-003-001
	1	PWB FAB FWD/REFL	7-30-377-001

REF DESIGNATOR	QTY	DESCRIPTION	PART NUMBER
A4		**PCB ASSY PWR CTRL FWD**	**4-30-377-001**
C1	1	CAPACITOR PORC CHIP ATC100 100PF	7-03-411-101
C11 C12 C13 C14	4	CAPACITOR CER 50V Z5U .01UF	7-03-502-103
C2 C3 C4 C5 C6 C10	6	CAPACITOR ELECTR AXL 50V 10MF	7-03-706-106
C7	1	CAPACITOR CER 50V Z5U .033MF	7-03-502-333
C9	1	CAPACITOR CER 50V Z5U 1UF	7-03-502-105
D1 D5 D6	3	DIODE SIGNAL 1N4148	7-06-003-001
D2	1	DIODE ZENER 1W 5% 4.7V 1N4732A	7-06-001-947
J4 J5	2	HEADER PCB 22-23-2121	7-19-006-012
JP1 JP2 JP3 JP5 JP6 JP7 JP9	7	HEADER PCB 2-PIN	7-19-095-002
JP1 JP2 JP3 JP5 JP6 JP7 JP9	7	HEADER JUMPER GOLD CONTACT	7-19-097-001
K1	1	RELAY JWD172-5	7-17-003-001
Q1 Q2	2	FET GP VN10KMT VN10KM	7-07-001-001
Q3	1	TRANSISTOR GP PNP 2N3906	7-07-125-001
Q4	1	TRANSISTOR GP NPN 2N4400	7-07-030-001
R1 R4 R5	3	POTENTIOMETER TRIMMING 15T 1W 10K	7-02-005-103
R11	1	RESISTOR MF 2W 1.8K	7-01-304-182
R12 R25	2	RESISTOR CF 1/4W 2K	7-01-201-202
R16	1	RESISTOR CF 1/4W 5% 470K	7-01-201-474
R18	1	RESISTOR CF 1/2W 510 OHM	7-01-202-511
R19	1	RESISTOR CF 1/2W 10K	7-01-202-103
R2 R3	2	RESISTOR CF 1/4W 5.1K	7-01-201-512
R27	1	RESISTOR CF 1/4W 24K	7-01-201-243
R6 R10 R14 R24 R26	5	RESISTOR CF 1/4W 10K	7-01-201-103
R7	1	RESISTOR CF 1/4W 15K	7-01-201-153
R8 R9 R15	3	RESISTOR CF 1/4W 47K	7-01-201-473
U1	1	IC REGULATOR 12V MC7812CT	7-08-013-004
U2	1	IC DC-DC CONVERTER ICL7662CPA	7-08-019-002
U3	1	IC VOLTAGE REG -5V MC7905CT	7-08-025-001
U4	1	IC OP AMP MC34074P	7-08-038-001
U5	1	IC OP AMP LM111J8 OR PM111Z	7-08-034-001
	1	PWB FAB FWD/REFL	7-30-377-001

REF DESIGNATOR	QTY	DESCRIPTION	PART NUMBER
A5		**AMP ASSY 210L DRIVER FINAL**	**4-62-175-001**
A1	1	AMP PCB ASSY DRIVER 210L	4-30-382-001
L10B L13B L10A L13A	4	INDUCTOR ASSY RFC 24 MAG	4-05-028-001
P1	1	CONNECTOR POWER PLUG 6-POS	7-19-004-006
P1	5	CONNECTOR PIN PLUG	7-19-005-002
Q1 Q2	2	FET PWR TMOS N MRF134	7-07-039-001
Q3	1	FET PWR TMOS N MRF136	7-07-008-001
Q4 Q5	2	FET PWR TMOS N MRF137 VHF 30W	7-07-086-001
S1	1	SWITCH THERMAL 160 DEG NC	7-16-004-160
	5	TERMINAL FORKED	7-20-030-001
	1	PANEL SIDE AIRDUCT	7-40-012-001
	1	PANEL SIDE AIRDUCT	7-40-012-002
	1	CHANNEL BOTTOM AIR DUCT 737FC	7-40-013-001
	2	COVER AIRDUCT	7-40-014-001
	2	BRACKET DUAL MOUNTING INDUCTOR	7-40-223-001
	8	PLATE PWB MATERIAL BEAD HOLDER	7-40-224-001
	1	PLATE HEATSINK DRIVER	7-40-280-001
	1	HEATSINK DRIVER 210L 6.080 X 9.5	7-43-101-001

REF DESIGNATOR	QTY	DESCRIPTION	PART NUMBER
A5A1		**AMP PCB ASSY DRIVER 210L**	**4-30-382-001**
C1 C2 C3 C4 C5 C6 C7 C8 C9 C28 C31 C39 C44 C47	15	CAPACITOR CER 50V Z5U 1UF	7-03-502-105
C10 C13 C11 C36	4	CAPACITOR CER CHIP ATC200 .1UF	7-03-412-104
C12 C20 C25 C34 C42 C51 C52 C53	8	CAPACITOR ELECTR RAD 50V 10MF	7-03-704-106
C17	1	CAPACITOR PORC CHIP ATC100 62PF	7-03-411-620
C18	1	CAPACITOR PORC CHIP ATC100 200PF	7-03-411-201
C19 C21 C24 C26 C27 C33 C35 C41 C43 C45 C48	11	CAPACITOR ELECTR AXL 50V 4.7MF	7-03-706-475
C22 C15 C23 C16	4	CAPACITOR PORC CHIP ATC100 36PF	7-03-411-360
C29	1	CAPACITOR MICA SIL DIP 5% 20PF	7-03-101-200
C30 C38	2	CAPACITOR ELECTR AXL 35V 22MF	7-03-702-226
C32 C40	2	CAPACITOR CER CHIP ATC200 .01UF	7-03-412-103
C37 C56	2	CAPACITOR ELECTR AXL 50V 2200MF	7-03-706-228
C46 C49	2	CAPACITOR PORC CHIP ATC100 15PF	7-03-411-150
C50	1	CAPACITOR MICA SIL DIP 5% 10PF	7-03-101-100
D1 D2 D3 D4 D5 D6	6	PIN-DIODE HP5082-3080	7-06-013-001
D7 D8	2	DIODE RECT 1A 140PIV 1N4003	7-06-002-003
L1 L3 L6A L6B	4	INDUCTOR 2.5mH	7-05-053-252
L11 L12	2	INDUCTOR ASSY RFC 22T 22 MAG	4-05-184-001
L2 L4	2	INDUCTOR RF MOLDED .22UH	7-05-006-228
L7	1	INDUCTOR ASSY RFC 6T 22 MAG	4-05-111-006
L7 L10	2	INDUCTOR RF MOLDED 1.0UH	7-05-006-108
R1 R2 R7 R8	4	RESISTOR CF 1/4 7.5 OHM	7-01-201-759
R10	1	RESISTOR MF 2W 510 OHM	7-01-304-511
R11 R19	2	RESISTOR CF 1/2W 750 OHM	7-01-202-751
R12 R20 R27 R35 R40	5	POTENTIOMETER TRIMMING 20T 1/2W 10K	7-02-007-103
R13	1	RESISTOR CF 1/2W 220 OHM	7-01-202-221
R14	1	RESISTOR CF 1/2W 2.7 OHM	7-01-202-279
R15 R23 R34 R39	4	RESISTOR CF 1/2W 1K	7-01-202-102
R18	1	RESISTOR CF 1/2W 18 OHM	7-01-202-180
R21	1	RESISTOR CF 1/2W 100 OHM	7-01-202-101

REF DESIGNATOR	QTY	DESCRIPTION	PART NUMBER
R22 R31	2	RESISTOR CF 1/2W 300 OHM	7-01-202-301
R24 R16 R17 R25	4	RESISTOR CF 1/2W 15 OHM	7-01-202-150
R26 R33 R38	3	RESISTOR CF 1/2W 51 OHM	7-01-202-510
R28	1	RESISTOR CF 1/2W 3K	7-01-202-302
R29	1	RESISTOR CF 1/2W 1 OHM	7-01-202-109
R3	1	RESISTOR CF 1/4W 150 OHM	7-01-201-151
R30	1	RESISTOR CF 1/2W 150 OHM	7-01-202-151
R32 R37 R43	3	RESISTOR MF 2W 1K	7-01-304-102
R36A R36B R42A R42B	4	RESISTOR MF 2W 200 OHM	7-01-304-201
R4 R5 R6	3	RESISTOR CF 1/2W 2K	7-01-202-202
R41	1	RESISTOR CF 1/2W 1.5K	7-01-202-152
R44	1	POTENTIOMETER TRIMMING SURF MNT 200 OHM	7-02-017-201
R45	2	RESISTOR MF 2W 2.7 OHM	7-01-304-279
R9	1	RESISTOR CF 1/4W 15 OHM	7-01-201-150
T1	1	TRANSFORMER ASSY RF 13" RG188	4-05-158-001
T2	1	TRANSFORMER ASSY RF 25" RG188	4-05-159-001
U1	1	IC REGULATOR VOLTAGE +12V LM78L12AC	7-08-015-003
U1	1	AMPLIFIER HYBRID MWA230	7-10-003-001
	1	PCB AMP DRIVER 210L	7-30-382-001

REF DESIGNATOR	QTY	DESCRIPTION	PART NUMBER
A6		**AMP ASSY 720FL**	**4-62-186-002**
A6A1	1	PCB AMP ASSY 720FL 200-1000MHz	4-30-332-004
C13	1	CAPACITOR CER 50V Z5U .01UF	7-03-502-103
C25	1	CAPACITOR PORC CHIP ATC100 4.7PF	7-03-411-479
C47 C49 C53 C55	4	CAPACITOR CHIP 6.8PF 50V SIZE A	7-03-419-689
C58 C59	2	CAPACITOR PORC CHIP ATC100 1.2PF	7-03-411-129
C? C??	2	CAP CER VAR SURF MNT 25V 1.5-6PF	7-04-004-609
J1 J2	2	CONNECTOR SMA 4-HOLE FLANGE MNT	7-19-009-001
Q1 Q2	2	FET PWR TMOS N D2001	7-07-091-003
Q3	1	TRANSISTOR FET PWR TMOS N D1016	7-07-093-002
Q4 Q5	2	FET PWR TMOS N D1053	7-07-110-003
R19 R33	2	RESISTOR TERMINATION 40W	7-01-901-003
R4	1	RESISTOR CF 1/4W 82 OHM	7-01-201-820
R8 R12 R14	3	RESISTOR CF 1/4W 120 OHM	7-01-201-121
S1	1	SWITCH THERMAL 160 DEG NC	7-16-004-160
T11 T12 T13 T14	4	TRANS ASSY RF COAXIAL 1.8" 12.44	4-05-119-003
T7 T8 T9 T10	4	TRANS ASSY RF COAXIAL 1.8" 12.44	4-05-119-006
	1	SCREWLOCK FEMALE D20418-2	7-19-093-001
	1	CONNECTOR D-SUBMIN 7W2P	7-19-138-001
	2	CONTACT HIGH POWER #12P	7-19-140-002
	2	CORE TOROIDAL 2673000801	7-24-005-001
	1	COVER ENCLOSURE 720F	7-42-091-002
	1	ENCLOSURE MACHINED 720F	7-42-102-001
	1	STANDOFF AL 1/4RND 4-40THD 1"LG	7-51-007-016

REF DESIGNATOR	QTY	DESCRIPTION	PART NUMBER
A6A1		**PCB AMP ASSY 720FL**	**4-30-332-004**
A1	1	AMPLIFIER HYBRID MWA330	7-10-005-001
C10 C14 C16 C17 C20 C21 C22 C23 C26 C27 C28 C31 C32 C33 C42 C43 C44 C45 C50 C51 C56 C57 C65 C66 C67 C68A C68B C69A C69B C74 C78	31	CAPACITOR CHIP .1uF 50V MINI	7-03-419-104
C11 C62	2	CAPACITOR ELECTR RAD 50V 10MF	7-03-704-106
C15 C38 C39 C63 C64	5	CAPACITOR PORC CHIP ATC100 100PF	7-03-411-101
C24 C58 C59 C71 C72	5	CAPACITOR PORC CHIP ATC100 1.2PF	7-03-411-129
C34	1	CAPACITOR ELECTR RAD 35V 22MF	7-03-707-226
C5 C7 C13	3	CAPACITOR CER CHIP ATC200 .01UF	7-03-412-103
C6 C8	2	CAPACITOR PORC CHIP ATC100 56PF	7-03-411-560
C60 C61 C18 C29 C30 C35 C37 C40 C41	9	CAPACITOR CER CHIP ATC200 .1UF	7-03-412-104
C70 C73	2	CAPACITOR PORC CHIP ATC100 2.4PF	7-03-411-249
C9 C? C??	3	CAPACITOR TRIMMER 2.0-10.0 PF	7-04-004-100
CR1	1	PIN-DIODE HP5082-3080	7-06-013-001
CR2 CR3	2	DIODE RECT 1A 560PIV 1N4004	7-06-002-004
L11	1	INDUCTOR RF MOLDED 3.3UH	7-05-006-339
L16 L17	2	INDUCTOR ASSY RFC 6T 22 MAG	7-05-010-006
L18 L19	2	INDUCTOR ASSY RFC 2T 22 MAG	4-05-161-001
L5	1	INDUCTOR ASSY RFC 8T #32 MAG	4-05-188-001
L6 L7	2	INDUCTOR RF MOLDED 1.5UH	7-05-006-159
L8 L9 L10	3	INDUCTOR ASSY RFC 5T 28 MAG	4-05-161-002
QH1 QH2	2	SAGEWIRE COMBINER/SPLITTER 2.75"	7-27-013-027
R1	1	RESISTOR MF 2W 390 OHM	7-01-304-391
R11 R13	2	RESISTOR CF 1/4W 22 OHM	7-01-201-220
R15 R16	2	RESISTOR CF 1/4W 1.2K	7-01-201-122
R2	1	RESISTOR CF 1/2W 1K	7-01-202-102
R20 R21 R22 R23 R28 R29 R30 R31	8	RESISTOR 15 OHM 1/8W 5%	7-01-200-150
R24 R27	2	RESISTOR CF 1/4W 1K	7-01-201-102
R3	1	RESISTOR CF 1/4W 750 OHM	7-01-201-751

REF DESIGNATOR	QTY	DESCRIPTION	PART NUMBER
R32	1	RESISTOR MF 2W 1K	7-01-304-102
R5 R9	2	RESISTOR 51 OHM 1/8W 5%	7-01-200-510
R6 R10 R17 R18 R25 R26	6	POTENTIOMETER TRIMMING 20T 1/2W 10K	7-02-007-103
R7	1	RESISTOR CF 1/2W 910 OHM	7-01-202-911
T1 T2 T3 T4	4	TRANSFORMER ASSY RF COAXIAL 2"	4-05-209-015
T5 T6 T15 T16	4	TRANSFORMER ASSY RF COAXIAL 2.5"	4-05-208-021
VR1 VR2	2	IC REGULATOR VOLTAGE +12V LM78L12AC	7-08-015-003
	1	720F PRINTED WIRING AMPLIFIER	7-30-332-001

5.0 DRAWINGS

The following pages are drawings. Some pages may be blank indicating that drawing was not available at the time this manual was prepared. This drawing may be obtained at a later date by contacting Kalmus Customer Service indicating the required drawing by the 12 character drawing number shown on the blank page.

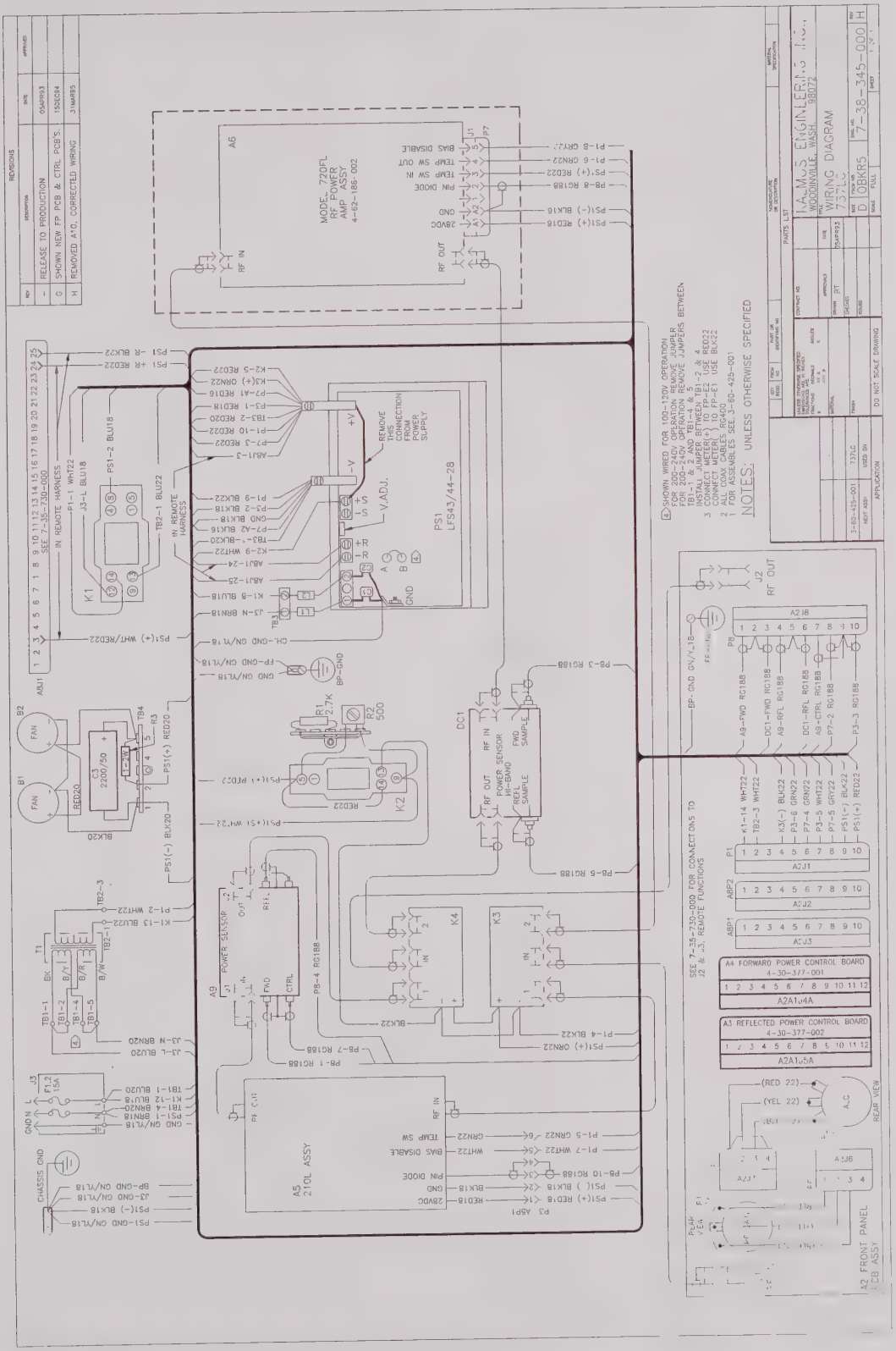
KALMUS

21820 87TH SE

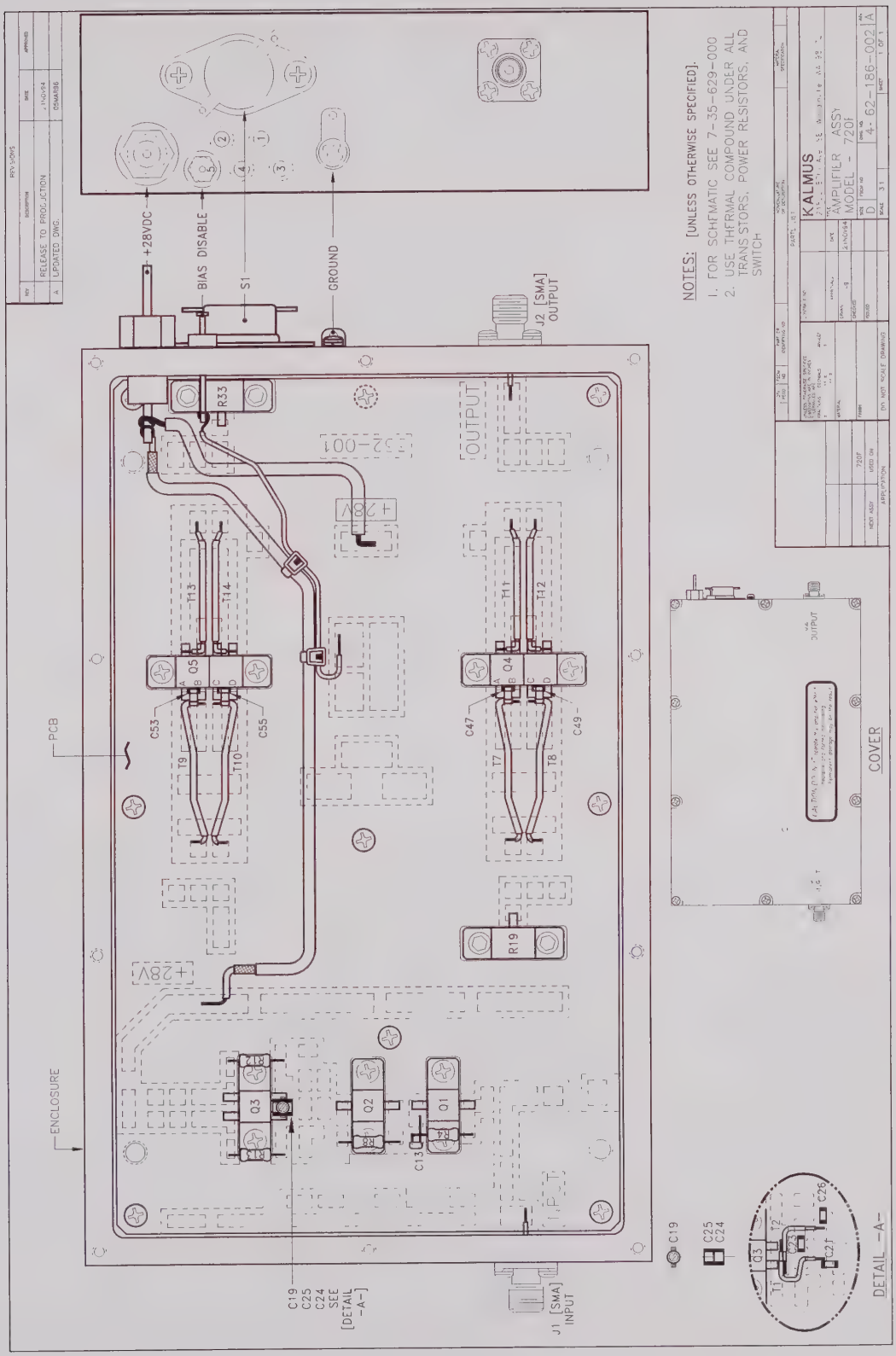
WOODINVILLE, WASHINGTON 98072

Telephone (206) 485-9000

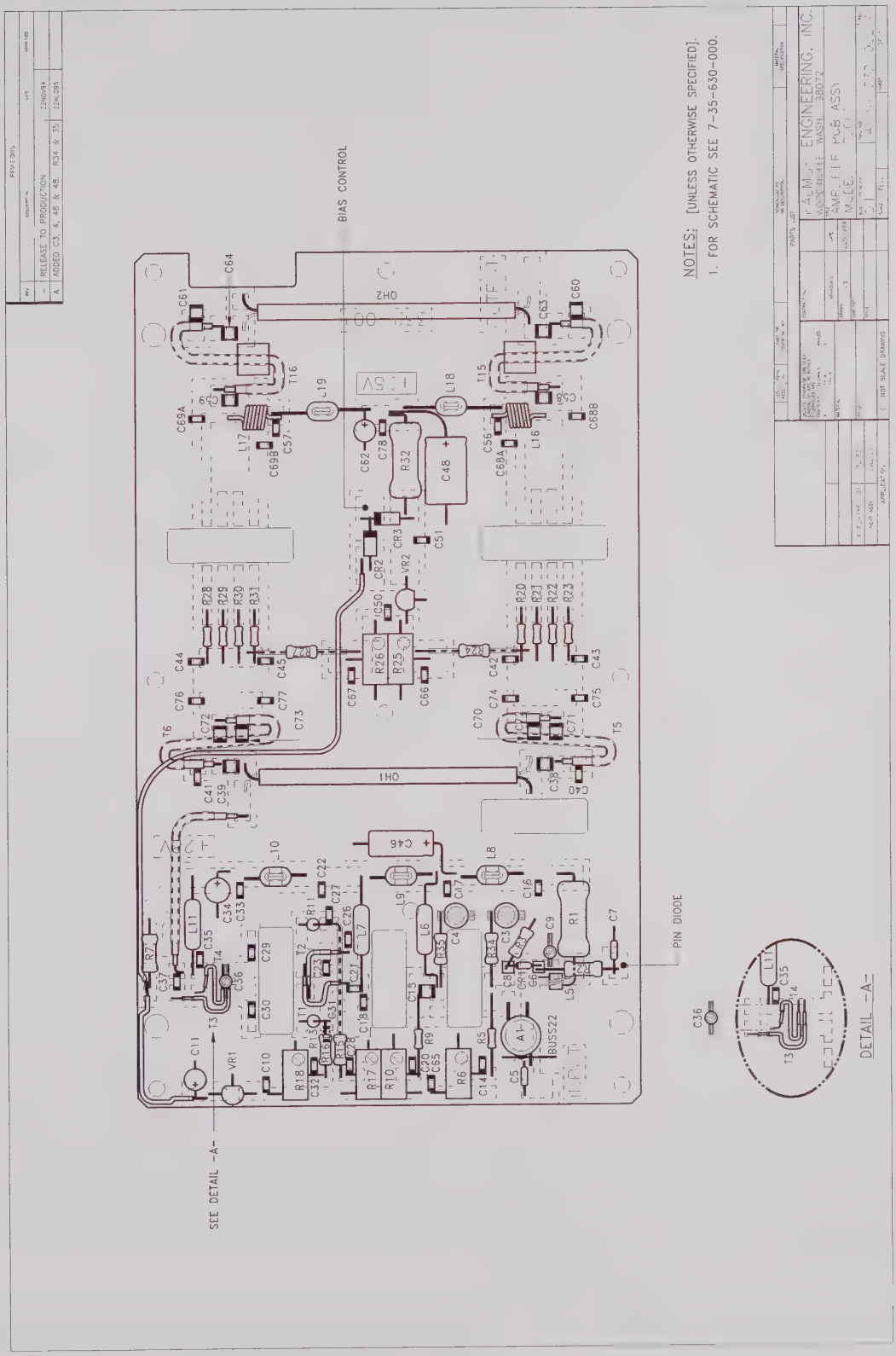
FAX (206) 486-9657



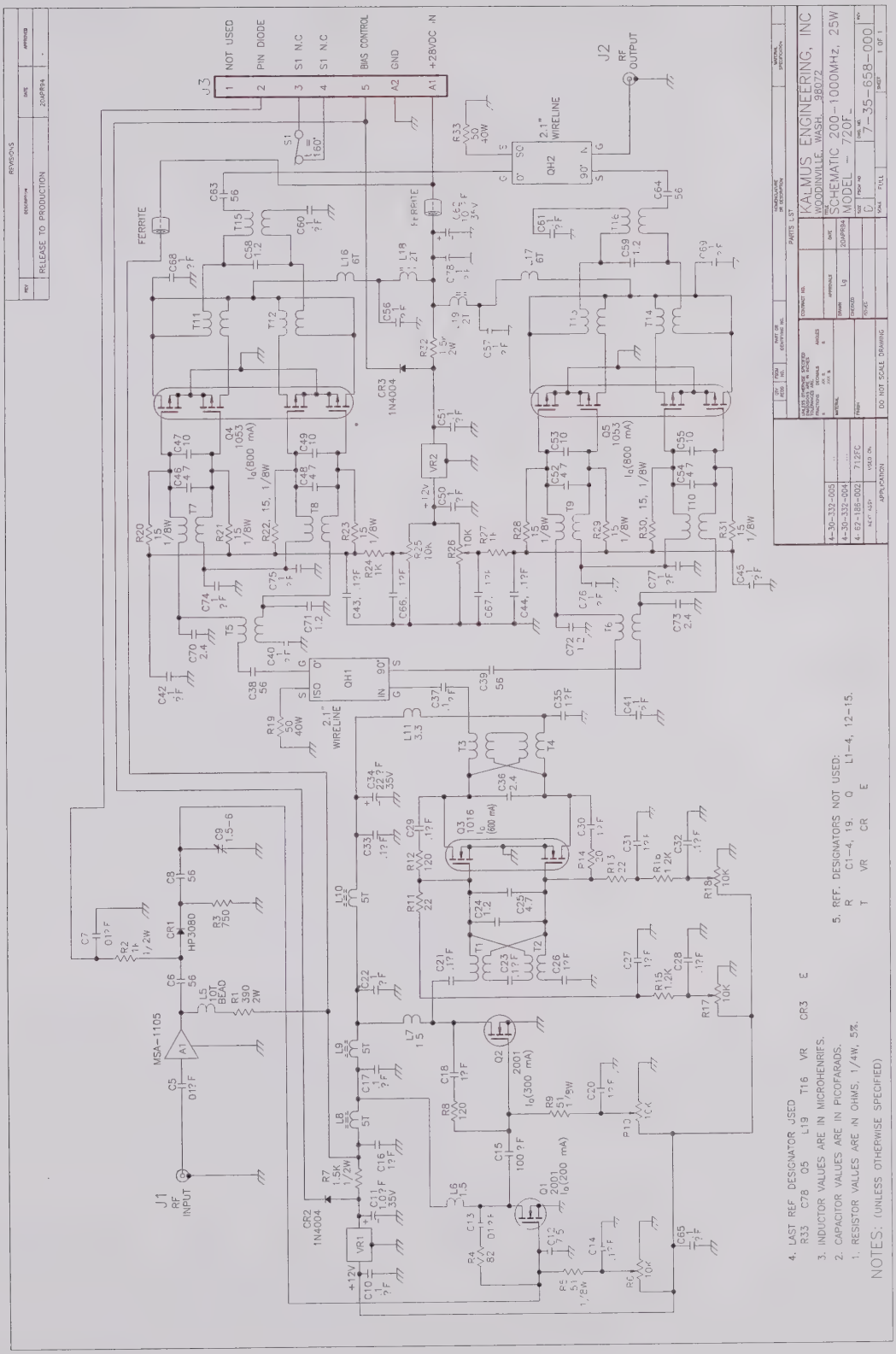
737LC Wiring Diagram, 7-38-345-000



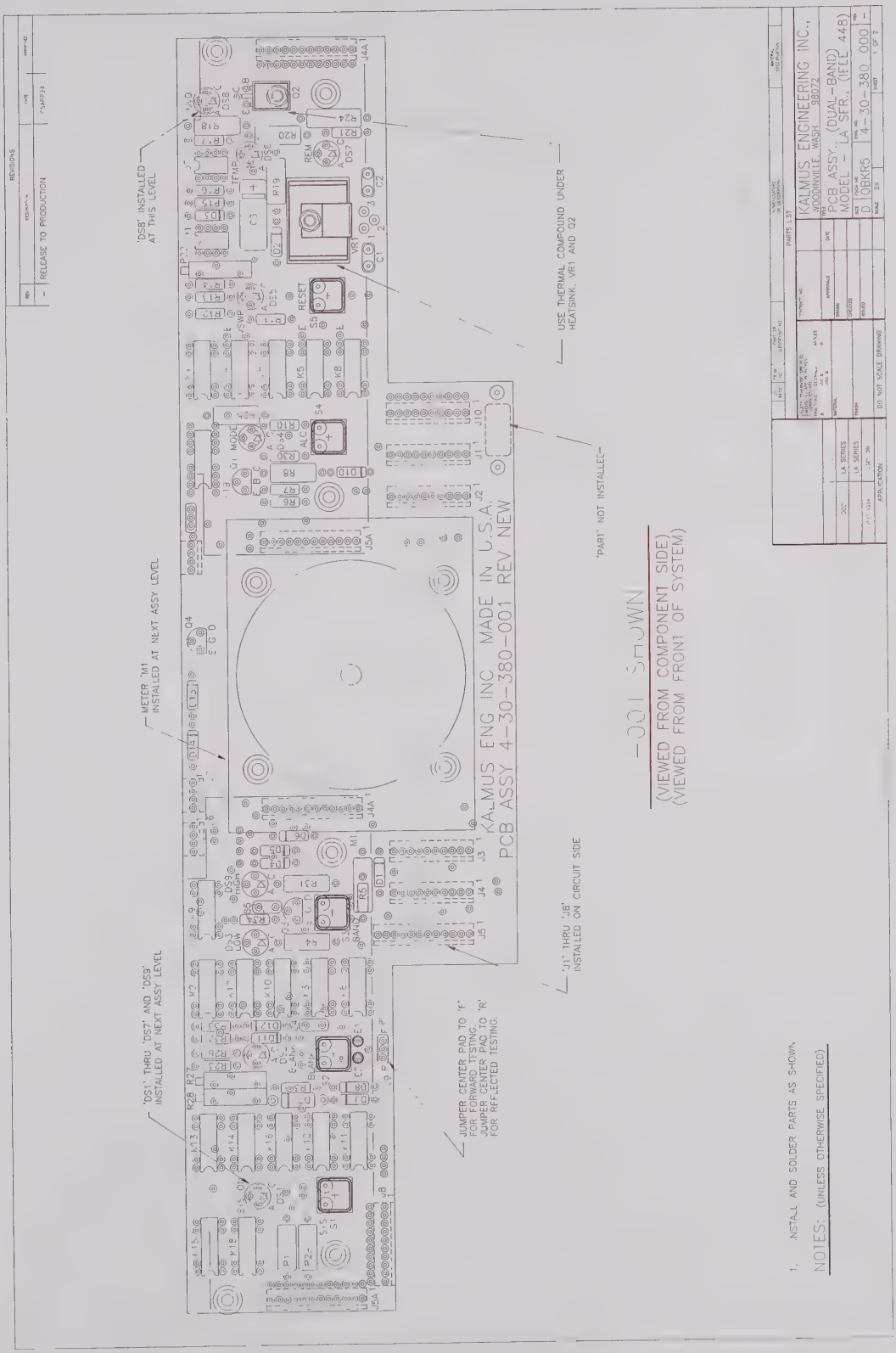
720FL Amplifier Assy, 4-62-186-002



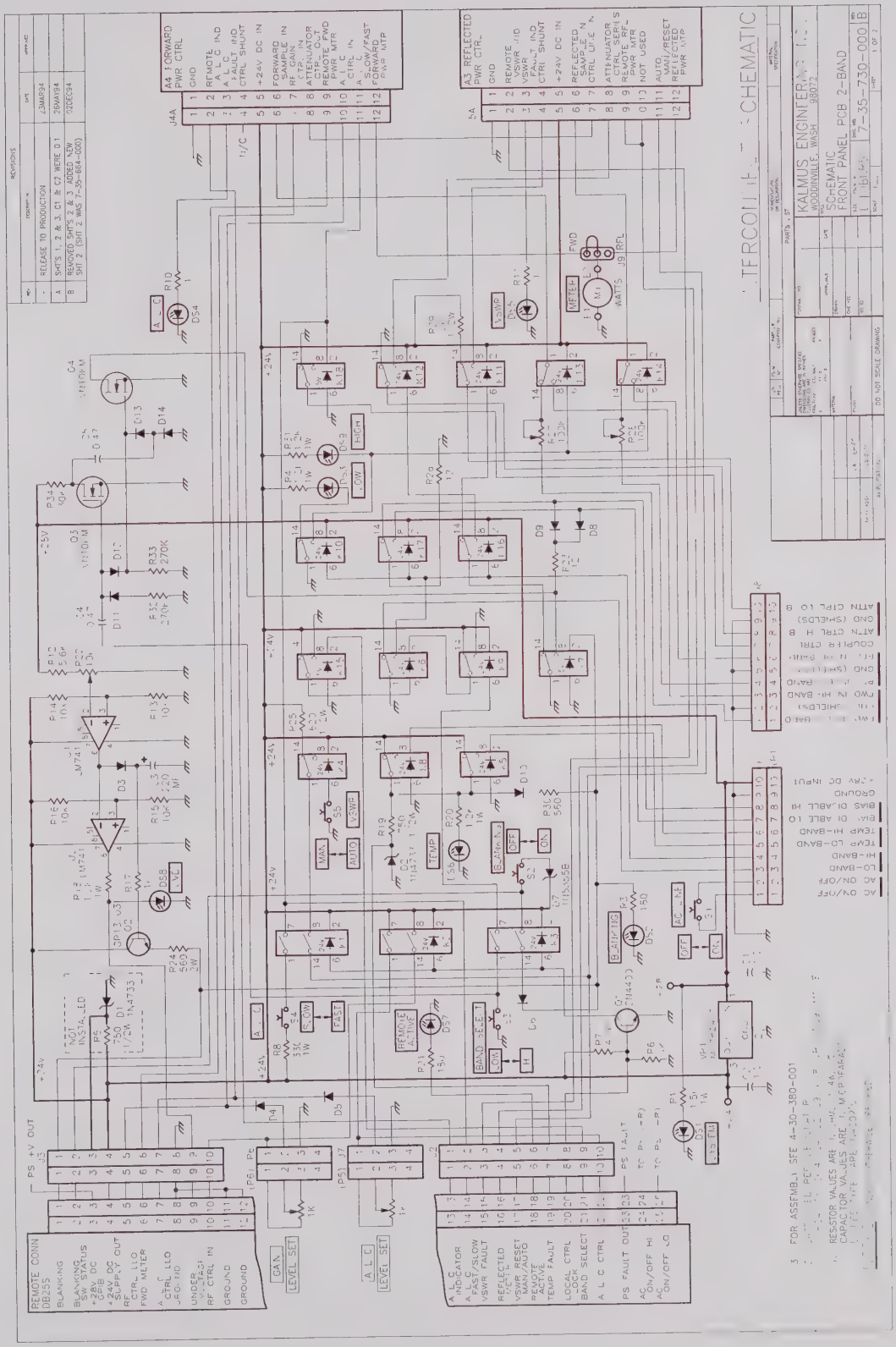
720FL Amplifier PCB Assy, 4-30-332-004 (see 4-30-332-002)



Schematic 720FL Amplifier, 7-35-658-000


'DS8' INSTALLED AT THIS LEVEL
USE THERMAL COMPOUND UNDER HEATSINK: VR1 AND Q2
'PART' NOT INSTALLED
METER 'M1' INSTALLED AT NEXT ASSY LEVEL
'DS1' THRU 'DS7' AND 'DS9' INSTALLED AT NEXT ASSY LEVEL
'J1' THRU 'J8' INSTALLED ON CIRCUIT SIDE
JUMPER CENTER PAD TO 'F' FOR FORWARD TESTING. JUMPER CENTER PAD TO 'R' FOR REFLECTED TESTING.
KALMUS ENG INC MADE IN U.S.A. PCB ASSY 4-30-380-001 REV NEW
-001 SHOWN
(VIEWED FROM COMPONENT SIDE)
(VIEWED FROM FRONT OF SYSTEM)
REVISIONS
RELEASE TO PRODUCTION
PARTS LIST
KALMUS ENGINEERING INC.
WOODINVILLE WASH 98072
PCB ASSY (DUAL-BAND) MODEL - LA SFR, (FILE 448)
4-30-380-001
NOTES: (UNLESS OTHERWISE SPECIFIED)
1. INSTALL AND SOLDER PARTS AS SHOWN
DO NOT SCALE DRAWING

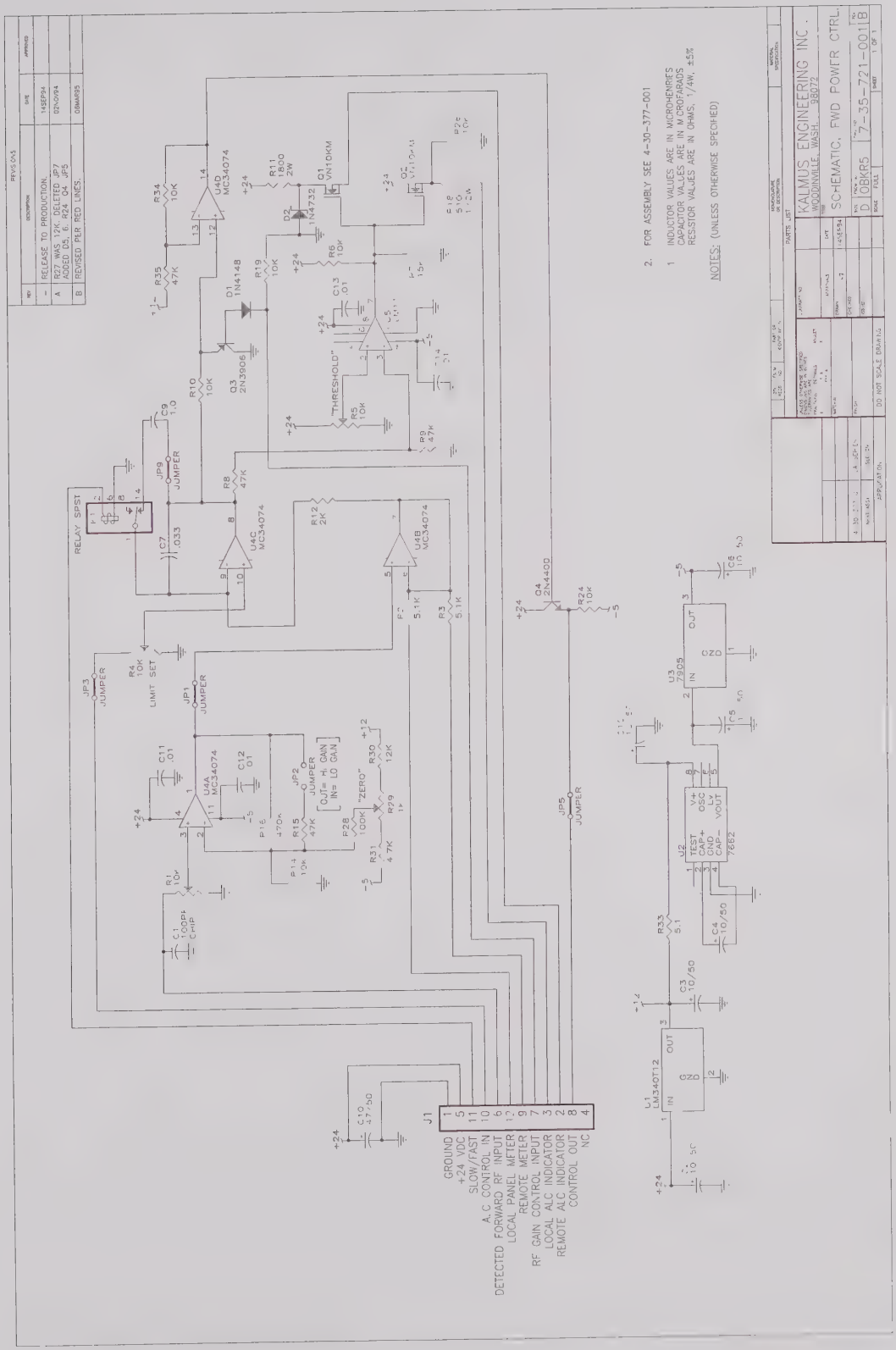
Front Panel PCB Assy, 4-30-380-001



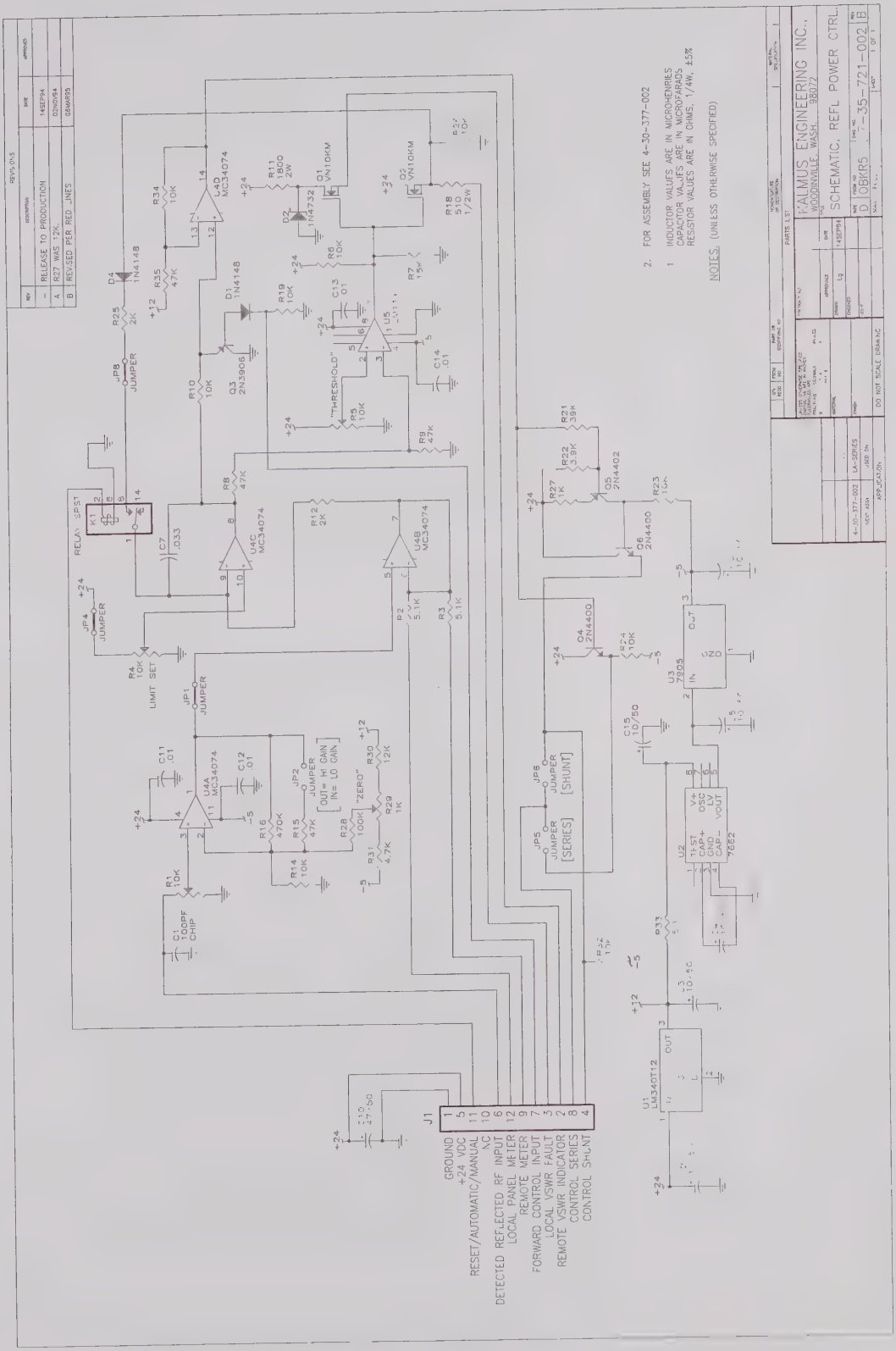
Schematic Front Panel PCB, 7-35-730-000

'J4A' AND 'J5A' INSTALLED ON COMPONENT SIDE
-001 (REV A) SHOWN
(CIRCUIT TRACES SHOWN)
(VIEWED FROM CIRCUIT SIDE)
-001 (REV A) SHOWN
(VIEWED FROM COMPONENT SIDE)
(SEE SCHEMATIC 7-35-721-001)
USE THERMAL COMPOUND UNDER U1 AND U3
'CIRCLE' OR 'MARK' APPROPRIATE NUMBER TO WHICH P.C.B. IS ASSEMBLED
-002 (REV A) SHOWN
(SEE SCHEMATIC 7-35-721-002)
USE THERMAL COMPOUND UNDER U1 AND U3
'CIRCLE' OR 'MARK' APPROPRIATE NUMBER TO WHICH P.C.B. IS ASSEMBLED
KALMUS ENGINEERING INC.
FWD / REF. PWB ASSEMBLIES
MODEL - LA SER. (EEE 448)
7-30-377

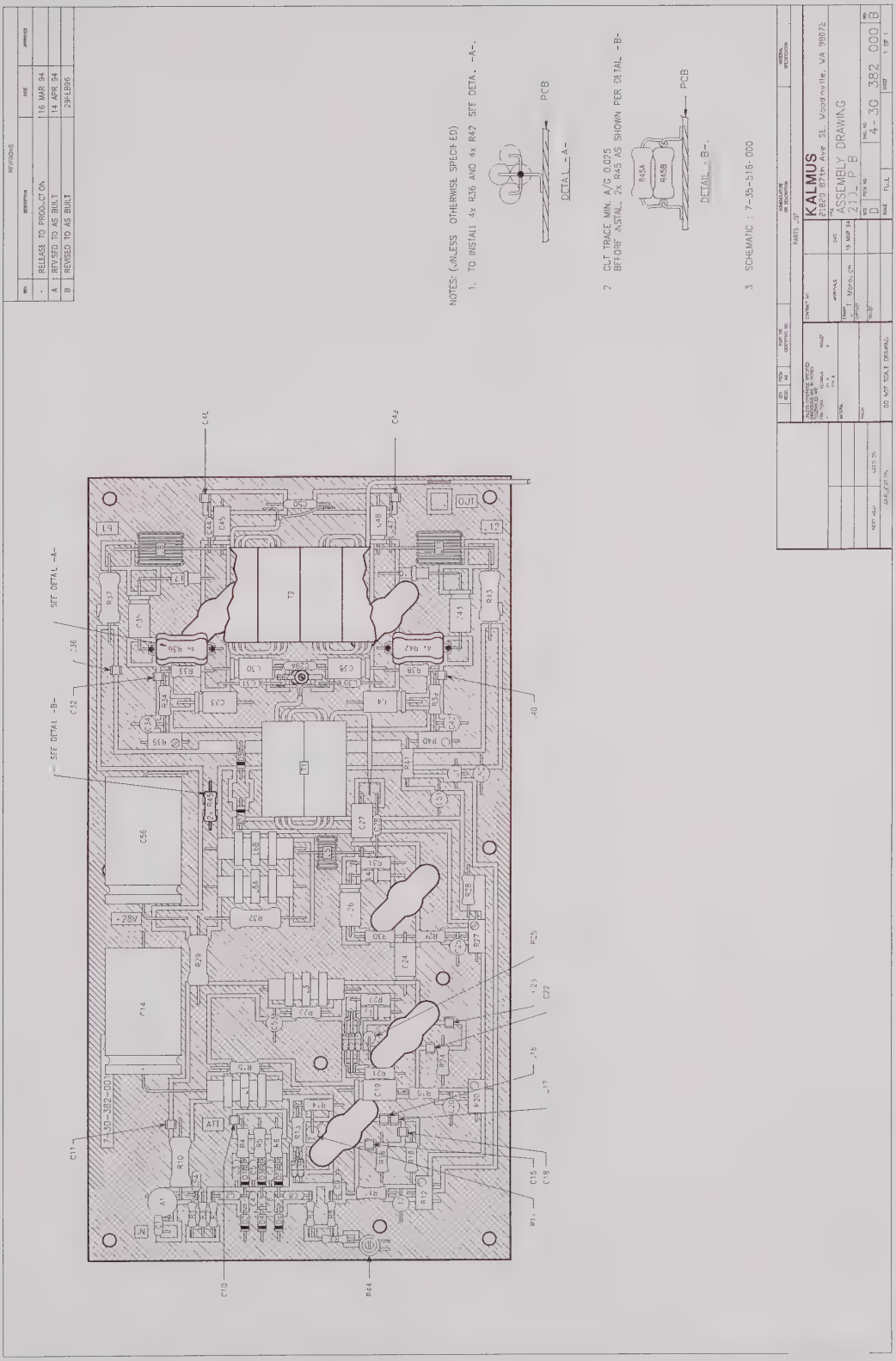
Forward/Reflected Power Control PCB Assy, 4-30-377-001/-002



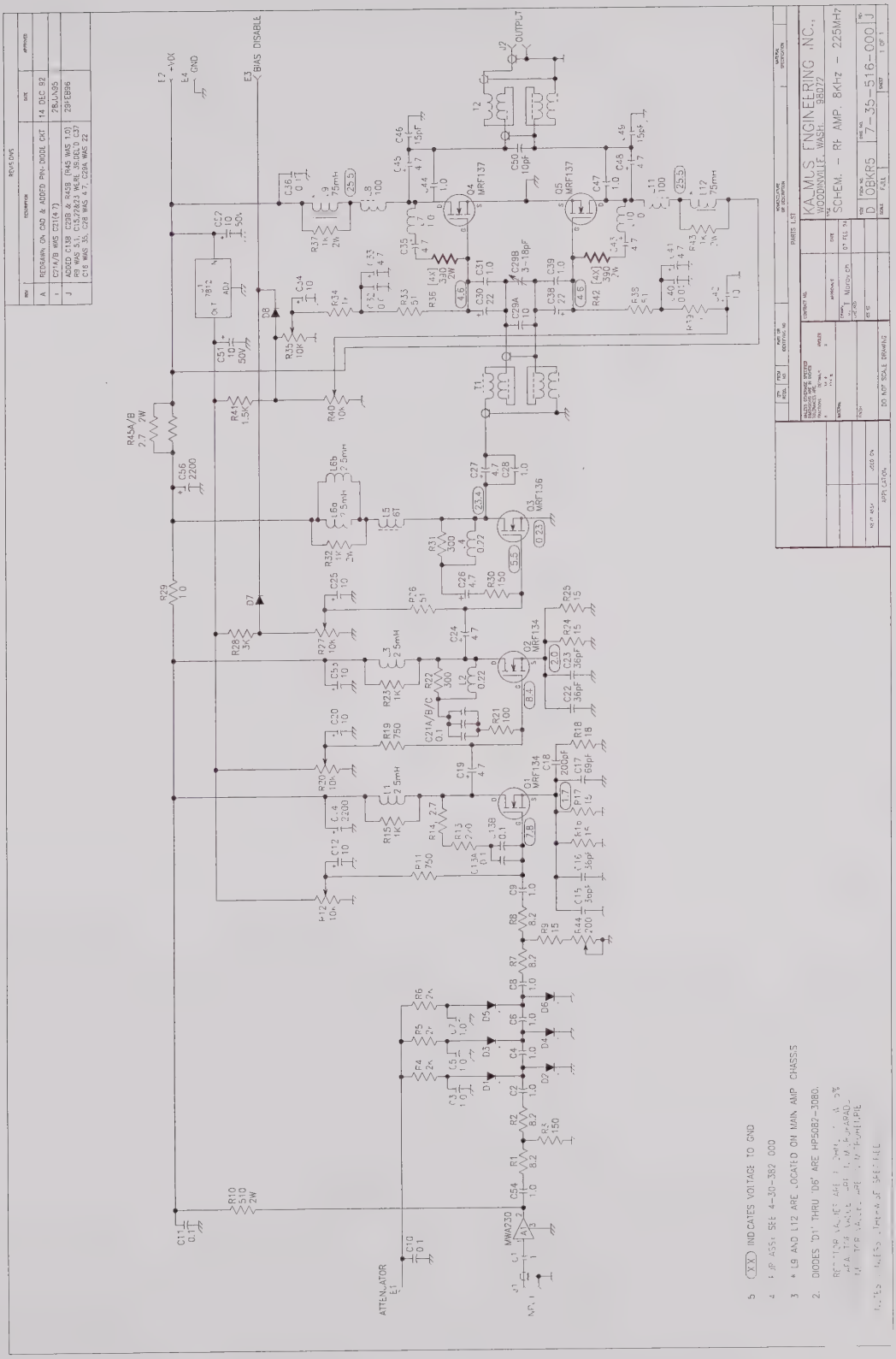
Schematic Forward Power Control PCB, 7-35-721-001



Schematic Reflected Power Control PCB, 7-35-721-002



210L Amplifier Driver PCB Assy, 4-30-382-001


REVISIONS
REDRAWN, ON CKD & ADDED PIN, DIODE, CKT
C17/18 WAS C11(4 T)
ADDED C128 @ 4458 (W45 WAS 10) R9 WAS 3.3, C15,28&23 WERE .39 DELD C37 C16 WAS 35, C28 WAS 4.7, C29A WAS 22
KA.M.S. ENGINEERING INC.
WOODINVILLE, WASH. 98072
SCHEM. - RF AMP. 8KHz - 225MHz
7-35-516-000
DO NOT SCALE DRAWING
OUTPUT
+VDX
GND
BIAS DISABLE
ATTENUATOR
MWA230
MRF134
MRF137
7812
PARTS LIST
1. DIODES "D1" THRU "D6" ARE HP5082-3080.
2. RESISTOR VALUES ARE IN OHMS, 1/4W, 5% UNLESS OTHERWISE SPECIFIED.
3. * L9 AND L12 ARE LOCATED ON MAIN AMP CHASSIS
4. (XX) INDICATES VOLTAGE TO GND
5. J1 ASSY SEE 4-30-382 000

Schematic 210L Amplifier Driver, 7-35-516-000

INSTRUCTION MANUAL

REGULATED POWER SUPPLIES

LFS-44 SERIES

SPECIFICATIONS AND FEATURES

DC OUTPUT — Voltage regulated for line and load. For voltage and current ratings see table I below.

TABLE I

MODEL	VOLTAGE RANGE	MAXIMUM CURRENT (AMPS) AT AMBIENT TEMPERATURE		
		40°C	50°C	60°C
LFS-44-2	2 ± 5%	60.0 (48.0*)	45.0 (38.3*)	33.5 (20.1*)
LFS-44-5	5 ± 5%	60.0 (48.0)	45.0 (38.3)	33.5 (20.1)
LFS-44-6	6 ± 5%	50.0 (40.0)	37.5 (31.9)	28.0 (16.8)
LFS-44-12	12 ± 5%	26.0 (20.8)	18.5 (15.7)	13.5 (8.1)
LFS-44-15	15 ± 5%	21.0 (16.8)	15.5 (13.2)	11.5 (6.9)
LFS-44-20	20 ± 5%	16.0 (12.8)	11.5 (9.8)	8.5 (5.1)
LFS-44-24	24 ± 5%	13.0 (10.4)	10.0 (8.5)	7.5 (4.5)
LFS-44-28	28 ± 5%	11.5 (9.2)	8.5 (7.2)	6.3 (3.8)
LFS-44-48	48 ± 5%	6.5 (5.2)	5.0 (4.3)	3.8 (2.3)

*Values in parentheses are for LFS-44 series units with K option (cover on unit).

Current range must be chosen to suit the appropriate maximum temperature. Current ratings apply for entire voltage range.

REGULATED VOLTAGE OUTPUT

Regulation (line) . . . . . 0.1% from 95 to 132 VAC or 187 to 265 VAC or 260-370 VDC.

Regulation (load) . . . . . 0.1% from 0 to full load.

Ripple and Noise . . . . . 15 mV rms, 75 mV peak-to-peak for LFS-44-2, -5 and -6; 20 mV rms, 150 mV peak-to-peak for LFS-44-12 through LFS-44-28; 35 mV rms, 200 mV peak-to-peak for LFS-44-48 (20 MHz bandwidth measurement system). Ripple specifications apply for output terminals floating or with either positive or negative terminal grounded.

Temperature Coefficient . . . . . 0.03% per °C

Remote Programming

External Resistor . . . . . Nominal 1000 Ohms/volt output. Increasing resistance increases output voltage. Use a low temperature coefficient resistor to assure most stable operation.

Programming Voltage . . . . . One-to-one voltage change. The programming supply must have a reverse current capability of 2 ma min.

Remote Sensing . . . . . Provision is made for remote sensing to eliminate the effect of power output lead resistance on DC regulation. Sensing leads should be a twisted pair to minimize AC pickup. A 10 μf elect, capacitor may be required between output terminals and sense terminals to reduce noise pickup. An additional capacitor may also be required across the load to further reduce noise pick up; the value of this capacitor will depend upon the particular application.

OVERSHOOT — No overshoot under conditions of power turn-on, turn-off, or power failure.

AC INPUT — 95 to 132 volts AC at 47 to 440 Hz, or 187 to 265 VAC at 47 to 440 Hz via field selectable jumper. (When shipped from factory, all LFS-44 power supplies are wired for 95 to 132 VAC input. To configure for 187 to 265 VAC input, remove jumper between P.C. Board terminals 'A' and 'B'). Where applicable, regulatory agency approval applies only for input voltages up to 250 VAC and for input frequencies in the range 47-63 Hz. Leakage current in the ground connection may exceed the limits allowed by these agencies at frequencies above this range.

DC INPUT — 260 to 370 volts DC (unit must be configured for 187 to 265 VAC as described above). Where applicable, regulatory agency approval only applies for input voltages up to 350 VDC.

EFFICIENCY — LFS-44-2 55% minimum, LFS-44-5 through LFS-44-15 75% minimum, LFS-44-20 through LFS-44-48 80% minimum.

INRUSH LIMITING — Turn on inrush current will not exceed 40 amps peak.

OVERLOAD PROTECTION — Automatic electronic current limiting circuit limits the output to a preset value, thereby providing protection for the load as well as the power supply. The current limit characteristic exhibits a region of constant current behavior (down to approximately 50% Vo(nominal)) followed by a foldback region.

HOLD UP TIME — LFS-44-2, LFS-44-5 and LFS-44-6 models will remain within regulation limits for at least 16.7 msec after loss of AC power when operating at maximum output power and 105 VAC input at 60 Hz, (or when configured for 220 V input: 20 msec holdup when operating at maximum output power and 210 VAC input at 50 Hz).

RECOMMENDED FUSING — 15 A, 250 V normal blow fuse in AC line (not supplied in unit) for 110 VAC input. Use 7A, 250 V for 220 VAC input. If IEC type fuses are used, value should be 75% of recommended current rating.

INPUT AND OUTPUT CONNECTIONS — See outline drawing for location. AC input, sensing and remote on/off connections are made via PC board mounted terminal blocks. Ground connection is made via a chassis mounted solder terminal. DC output connections are made via heavy duty bus bars. See figures 1-3 for supply-load connections.

REMOTE TURN-ON/TURN-OFF — T^2L compatable signal enables remote turn-on/off of the power supply. A voltage of 2.8 to 5.0 V applied between "+R" and "-R" will initiate turn-off. Open circuit or short circuit condition, or a zero to 0.5 volt signal will cause turn-on.

COOLING — Convection cooled; no external blowers required.

OPERATING AMBIENT TEMPERATURE RANGE AND DUTY CYCLE — Continuous duty from 0°C to +60°C ambient with corresponding load current ratings for all modes of operation. Unit will start up at -10°C, but may not meet published specs until internal heating raises temperature to 0°C.

STORAGE TEMPERATURE — -55°C to +85°C

DC OUTPUT CONTROL — Screwdriver voltage adjust control permits adjustment of DC output voltage. See outline drawing for location of control.

WARRANTY — 3 year warranty from date of shipment . . . materials and labor

PHYSICAL DATA

Size	1.9" x 4.75" x 11.75"
Weight	3.5 lbs. net; 4.5 lbs. shipping
Finish	Gray, FED.STD.595 No. 26081

MOUNTING — One surface with threaded mounting holes can be utilized for mounting this unit. All LFS-44 power supplies must be mounted in a horizontal plane with 4.75" dimension vertical. Air circulation is required when unit is mounted in confined areas. Refer to outline drawing for mounting details.

OVERVOLTAGE PROTECTION — Standard on all models. When output voltage increases above the maximum overvoltage detect of the unit and inverter drive is removed, input power must be removed. Maximum overvoltage detect level: LFS-44-2 4.2 V, LFS-44-5 6.85 V, LFS-44-6 7.6 V, LFS-44-12 14.9 V, LFS-44-15 19.3 V, LFS-44-20 26.5 V, LFS-44-24 31.5 V, LFS-44-28 36.7 V, LFS-44-48 60.6 V. Allow 2.5 min. for the overvoltage detector to reset and then reconnect input power for normal operation of the unit.

ISOLATION RATINGS — Input terminals to output : 1500V rms
Input terminals to ground : 1500V rms
Output terminals to ground : 500V rms

ACCESSORIES

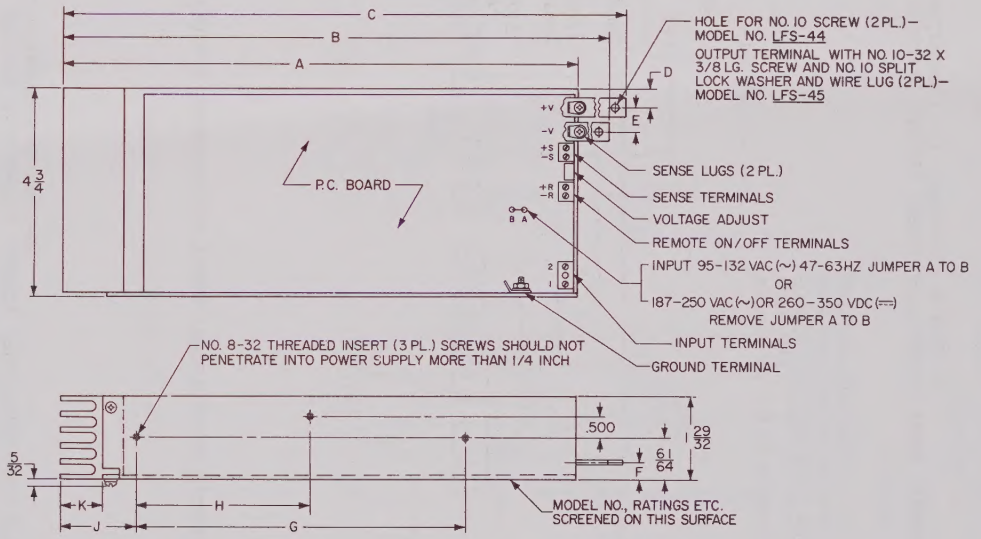
Rack Adapters	Rack adapters LRA-15 and LRA-17, with or without chassis slides, are available for all LFS-44 units.
Standard Power Systems	All LFS power supplies can be integrated into the Lambda standard power system assembly which provides panel mounted pilot light, voltage control, fuse and output metering for the power supply as desired.

SUPPLY — LOAD CONNECTIONS — See figures 1-3.

NOTE: In certain applications a toroid such as Stackpole no. 57-3206 may be required on the output grounding wire for noise reduction. The number of turns required will depend upon the particular grounding configuration used.

EMI — LFS-44 power supplies can be made to meet FCC docket 20780, class A conducted EMI compliance with the addition of LAMBDA filter ARA-00-024 or CORCOM filter 10ET1. Filter required for meeting VDE 0871 class A compliance with 187-250 VAC input voltage is LAMBDA filter ARA-00-022 or CORCOM filter No. 6EQ1.

	LFS-44	LFS-45
A	11 3/4	15 1/2
B	12 1/2	16 1/2
C	12 7/8	16 1/4
D	13/32	15/32
E	9/16	1.000
F	13/32	7/16
G	7.500	10.500
H	4.000	5.000
J	1 3/4	4 1/4
K	1"	1 25/32



Outline Drawing

LAMBDA QUALITY

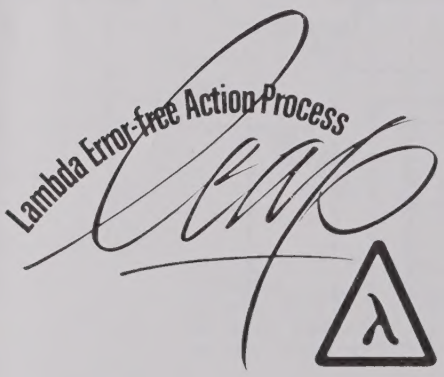
DEFINITION

Quality at Lambda means error-free output
which meets the needs and exceeds the expectations
of our internal and external customers.

IMPLEMENTATION

It is each individual's responsibility to understand
his or her customers' needs and expectations
and deliver products and services which achieve
Lambda Quality.

LAMBDA



LAMBDA ELECTRONICS INC.
515 BROAD HOLLOW RD., MELVILLE, NY 11747-3700 • TEL:516-694-4200 • FAX:516-293-0519

11/95

MP MASTER
MA25875